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EDITED BY J. C. ROBERTSON.

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"Otez à l'homme l'esprit d'invention et de combinaison, il devient incapable de se créer du travail; et sans travail, pas de produits, pas de richesse, pas de civilization."

JOBARD.

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PARIS, A. & W. GALIGNANI, RUE VIVIENNE;
HAMBURGH, W. CAMPBELL.

1851.

ALPHABETICAL LIST OF NEW PATENTS GRANTED FOR ENGLAND, SCOTLAND, AND IRELAND.

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Adams	Rifles and other fire-arms	23 Feb.	....	....	180
Adams	Galvanic electricity, collecting and burning hydrogen, &c.	29 May	14 May	....	439,439
Adams	Roads, ways, buildings, bridges, locomotive engines and carriages.	3 June	....	....	460
Adorno	Maps and globes	31 Jan.	....	....	100
Allan	Paving	11 Jan.	23 Dec.	....	60,12
Allen	Buttons	1 Feb.	....	....	119
Alliott	Cleaning, dyeing, and drying machines	3 Feb.	....	....	119
Amies	Braid	1 Feb.	3 Feb.	....	119,198
Anstey	Consuming smoke	11 Jan.	....	....	60
Appold	Regulating and ascertaining work of machinery	9 April	....	....	299
Archer	Tobacco	11 Jan.	....	....	60
Andrews	Steam engines, boilers, pumps, safety-valves, wheels, and axles	24 April	....	....	340
Ashe	Nautical instruments	....	29 Jan.	....	198
Ashworth	Preventing and removing incrustation	29 May	....	....	439
Auld	Steam engines and boilers.	....	2 Dec.	....	19
Babington	Preventing incrustation	....	16 April	....	340
Baildon	Writing, printing or marking	....	19 June	....	520
Bailey	Looped fabrics	23 May	....	....	439
Baldwin, Crossley and Collier	Carpets	....	12 March	....	299
Bancks	Paper	....	13 Dec.	....	19
Banister	Metallic Tubes	7 June	....	....	480
Barclay	Extracting, separating, refining and bleaching fatty matters	19 May	30 April	....	420,439
Barker	Chipping, rasping and shaving dyewood	7 April	....	....	299
Barlow	Propelling	11 Jan.	....	....	60
Barlow	Railway chairs	14 Jan.	....	....	60
Barlow and Gore	Gas and gas apparatus	15 April	9 April	....	319,339
Beadon	Roofing	18 Feb.	19 June	....	160,520
Bell	Sulphuric acid	23 Feb.	....	....	180
Bernard	Boots and shoes	....	29 Jan.	....	198
Berthon	Boats, sounding instruments, &c.	12 June	....	....	480
Bessemer	Centrifugal apparatus, sugar, &c.	....	6 Jan.	31 Dec.	139,139

302216

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Bessemer......	Sugar-cane press........	....	6 Feb.	....	198
Bessemer....	Manufacture & refining of sugar, producing a vacuum, &c.........	20 March	17 April	....	239,340
Betjemann	Bedsteads and frames....	15 April	....	....	319
Bielefield	Papier maché	29 Feb.	....	....	180
Birkett......	Obtaining soap from wash waters........	12 June	....	....	480
Black	Folding-machine........	....	3 April	....	339
Boggett and Smith	Heating, lighting, and steam engines	....	3 April	....	339
Booth	Generating and applying heat	10 March	....	....	220
Booth	Muffs, boas, tippets, &c..	31 March	....	....	279
Booth	Gas	....	19 June	....	520
Borland	Weaving machinery	....	30 April	....	439
Bower	Preparing, rating, and fermenting flax and grasses............	24 March	....	....	259
Bradshaw......	Fastenings for garments..	31 Jan.	....	....	100
Brasil	Dyeing and preparing dyewoods..........	24 June	....	....	519
Briand and Fell	Obtaining fresh from salt water..........	11 Feb.	....	....	139
Brisbane	Looms	....	14 March	....	299
Brooman	Steam machinery	....	24 Jan.	....	198
Brooman	Abdominal supporters ..	....	24 Jan.	....	198
Brooman	Screws	15 March	....	....	239
Brooman	Rope and cordage	2 April	....	....	279
Brooman	Purifying water	....	17 March	11 March	299,300
Brown	Wafers...............	7 Jan.	....	....	40
Brown	Raising and lowering weights	....	31 Dec.	....	120
Brown	Ships, boats, buoys, rafts, &c...........	10 Feb.	....	....	139
Brown	Helves	6 May	....	....	380
Browne	Disinfecting, purifying gas, &c..	....	9 April	....	339
Browne	Weaving, preparing, printing and staining.	....	1 May	....	439
Brunet......	Coverings for roofs, walls, boxes, &c....	10 March	....	....	220
Brunier	Obtaining power........	31 March	....	....	279
Buchholz ..	Printing, folding and cutting...........	16 Jan.	....	....	60
Buchholz....	Motive power, and propulsion............	17 Feb.	....	....	160
Bunnett	Public carriages	23 Jan.	....	....	80
Burgess	Cutting turnips	21 Jan.	17 Feb.	....	80,199
Bury	Cleaning and spinning raw silk	....	....	4 Nov.	20
Bury	Preparing, spinning and doubling	....	....	18 March	300
Bycroft	Securing warmth and dryness to travellers..	18 Jan.	....	....	80
Calvert......	Extracts for dyeing, printing, and tanning	12 June	18 June	....	480,520
Carpenter ..	Building, propelling, and directing ships......	13 May	....	....	399

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Chatterton ..	Protecting insulated electro-telegraphic wires.	12 June	....	....	480
Cheetham ..	Bleached and coloured yarns or threads	24 March	2 April	....	259,339
Christie	Preparing, carding, spinning, doubling, twisting, weaving, knitting, sewing and packing..	....	....	14 April	339
Clare	Casks	....	....	3 Feb.	199
Claussen	Bleaching, preparing materials for spinning and felting, yarns and felts	....	12 Feb.	1 Feb.	199,192
Clift	Soda, potash and glass ..	21 Jan.	....	....	80
Clift.........	Muriatic acid, soda potash, glass and chlorine	....	27 Jan.	....	380
Cogan	Application of glass	16 Jan.	....	....	60
Colegrave	Valves, feeding boilers, &c.	....	31 Dec.	14 Dec.	120,20
Cook	Metallic tubes..........	3 Jan.	....	....	40
Cooke	Soda and carbonate of soda..	3 May	....	....	380
Cooper......	Steam engines and railway breaks	....	5 March	....	299
Corry	Weaving figured fabrics ..	2 Jan.	13 Jan.	5 Feb.	40,139 199
Coutant	Hardening iron	15 April	....	....	319
Cowper	Retaining and drawing off soda-water......	16 Jan.	....	....	60
Cowper	Moulds for electro metallurgy	17 Feb.	....	....	160
Cowper	Coverings for buildings ..	3 May	....	....	380
Crook and Mason	Looms for weaving......	17 June	....	....	500
Cross	Textile fabrics, and wearing apparel	8 April	....	21 Nov.	299,20
Crossley	Carpets, and rugs	28 Jan.	....	....	100
Crossley	Beetroot, sugar, &c.	....	....	6 May	440
Crossley, Collier and Hudson........	Printing yarns, and weaving carpets	....	3 March	....	299
Cunningham ..	Reefing sails	....	4 April	....	339
Dalton........	Railways	26 April	....	....	360
Davies........	Wheel carriages	31 Jan.	24 March	....	100,339
Dawson	Umbrellas and parasols ..	13 March	....	....	220
Deakin......	Rolling metals, tubes, &c.	....	11 Dec.	....	19
De Bergue	Permanent way of railways	7 Feb.	27Jan.	....	119,198
De Douhet	Disoxygerating bodies	....	28 Nov.	....	19
De Durin..	Measuring persons and fitting garments	10 May	....	....	399
Delemer	Applying colouring matter	6 May	19 June	....	380,520
Dering........	Electric telegraphs	27 Dec.	17 Dec.	4 Jan	19,19,139
Dircks......	Gas, gas burners, and heating apparatus ..	23 Feb.	....	....	180
D'Orville and Partington..	Finishing thread or yarn..	....	31 Dec.	....	120

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Dumant	Electric telegraphs	7 Feb.	9 May	....	119,439
Dunn	Motive power	....	20 Dec.	....	20
Dunn	Reciprocating and rotary fluid meters....	24 March	....	....	259
Durand	Communicating intelligence	17 June	....	....	500
D'Urcle	Increasing produce of autumn wheat	12 June	....	....	480
East	Dressing, embossing, and ornamenting leather	15 April	....	....	319
Eccles	Looms	....	17 March	....	300
Eccles, Bradshaw and Bradshaw..	Looms	....	....	4 Jan.	139
Elliott	Alkali	21 Jan.	....	....	80
Ellis	Blooms or piles for bars and plates of iron....	27 Feb.	....	....	180
Empson	Buttons	27 May	....	....	439
Ermen	Finishing yarns or thread.	17 June	....	....	500
Fairbairn and Hetherington	Mouldings for casing pipes, &c...........	10 Feb.	31 Jan.	....	131,198
Fevre	Soda water, &c.	24 Feb.	....	....	180
Findlay	Turning, cutting, and shaping wood	....	....	19 Dec.	20
Firmin	Oxalate of potash	24 June	....	....	519
Fletcher	Obtaining motive power..	21 June	....	....	419
Fontainemoreau.	Oscillating engines	....	7 Dec.	7 Dec.	19,20
Fontainemoreau.	Motive power	10 March	....	....	220
Fontainemoreau.	Mills	24 March	....	....	259
Fontainemoreau.	Fuel..................	3 May	....	....	380
Fontainemoreau.	Electric telegraphs	3 May	....	....	380
Forster........	Filtering water	....	31 Dec.	....	120
Fraser	Sugar	27 Dec.	....	....	19
Gage........	Tissue bandages, wafers, &c..	31 Jan.	....	....	100
Galloway	Steam engines...... ...	10 March	....	....	220
Galloway and Galloway ..	Steam engines, and boilers	10 March	14 April	....	220,339
Geddes........	Ornamental fabrics......	....	6 June	....	520
Gibbs	Paints, cements, and panels	....	20 Jan.	....	139
Goode, Boland and Newman	Chains, pins, swivels, brooches and fastenings	29 April	....	....	360
Gratrix........	Velvets and piled fabrics..	....	24 Dec.	20 March	120,439
Green	Preparation of peat......	....	....	21 Dec.	139
Greenough	Motive power	3 May	14 April	....	380,339
Grissell and Redwood ..	Coating metals..........	11 Jan.	....	....	60
Guillouet......	Indigo	10 March	....	....	220
Guthrie	Digging, tilling, or working land	24 March	14 March	....	259,299
Gwynne	Pumping, forcing, and exhausting fluids....	31 March	28 May	16 May	279,519 440

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Haddan	Railway carriages, wheels and panels..	....	9 Jan.	....	139
Haddan	Railways, carriages and papier maché	26 April	....	....	360
Haimes, Hancock and Thornton's	Knit and looped fabrics, and raising pile	10 May	28 April	....	299,439
Hall	Starch and gums........	11 Jan.	10 Jan.	....	60,139
Hallen	Gas burners............	10 May	....	....	399
Hamilton	Sawing, boring and shaping wood	....	23 Jan.	....	198
Hanson and Saunderson.	Propelling	....	18 Dec.	....	20
Hardy	Scythes	15 April	30 May	....	319,520
Harris........	Barometers.............	....	26 Feb.	....	299
Harrison	Textile fabrics, yarn and threads........	27 May	....	....	439
Hart..........	Bricks and tiles	17 March	....	....	239
Hartley	Glass	....	19 June	....	520
Hawkins	Brushes	24 March	....	....	260
Hawthorn and Hawthorn ..	Locomotive engines	24 Feb.	....	....	180
Hazlehurst	Iron..................	3 June	16 June	....	460,520
Hemsley.......	Looped fabrics..........	15 May	....	....	400
Henley......	Telegraphic communication	....	....	18 Jan.	139
Hepburn.......	Carriages and vehicles ..	17 June	....	....	500
Herring	Sugar, rum & evaporating	24 March	....	....	259
Hetherington .	Preparing, spinning and weaving	....	4 March	....	299
Heywood....	Railway and other carriages	11 Feb.	....	....	139
Hill	Preparing, spinning and doubling	....	3 Jan.	....	139
Hill	Railway chairs..........	24 March	17 April	....	259,340
Hinks	Metallic reels	14 June	....	....	500
Hinks and Vero......	Hats, caps and bonnets ..	24 Feb.	....	....	180
Hodges and Brockedon..	Surgical instruments	24 June	....	....	519
Holmes	Cutting and stamping metals	24 June	....	....	519
Holt..........	Textile fabrics..........	24 March	14 April	....	259,339
Hopkinson	Pianofortes.............	3 June	....	....	460
Horn	Cleansing carpets and matting	10 March	....	....	220
Horton........	Gas holders............	2 Jan.	30 Jan.	....	40,198
Howland......	Bell telegraphs	11 Feb.	....	....	140
Huckvale....	Treating mangel-wurtzel and making drinks therefrom..........	2 April	....	....	271
Hyam	Fastening down trousers..	26 April	....	....	369
Iles	Picture frames, inkstands, &c..........	....	5 May	....	439
Jacobs	Printing, colouring, shading, tinting and varnishing	....	2 May	....	439

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Jaquin	Nails, pins, tacks and screws	3 June	....	....	460
Johnson	Annealing	31 Jan.	....	....	100
Johnson	Steam engines and generators	....	29 Jan.	....	198
Jones	Apparatus used when burning candles	28 Dec.	....	....	19
Jowett	Railway breaks and carriages	10 March	....	....	220
Keely and Wilkinson	Textile and woven fabrics.	17 April	....	....	319
Kennedy.......	Carding engines	10 June	....	....	480
Kirkman.......	Spinning and twisting....	28 Feb.	....	....	199
Kossovitch	Rotary engines	3 May	29 April	2 May	380,439 439
Kurd and Wendle....	Sinking and lining shafts..	30 Jan.	14 Feb.	....	100,199
Lancaster....	Firearms, cannon and projectiles	16 Jan.	....	3 Jan.	60,139
Lawes	Generating and applying steam	4 Jan.	....	....	40
Leach	Carding, spinning, doubling and twisting....	28 Feb.	....	....	199
Le Bastier	Printing	....	27 Nov.	....	19
Ledru	Heating	24 March	....	....	259
Lerow	Sewing machines........	....	9 May	....	439
Lienau	Purifying and filtering oils.	18 Jan.	....	....	80
Lightfoot and Higginson..	Colouring matters	12 June	....	....	480
Lister	Preparing and combing wool..............	24 Feb.	....	....	180
Little	Electric telegraphs	14 March	....	....	239
Livingstone ..	Fuel..................	11 Jan.	....	....	60
Lloyd	Steam engines..........	24 Feb.	17 March	....	180,299
Longmaid	Treating ores, alkali, &c..	10 May	....	....	420
Loradoux......	Raising water and fluids..	21 Jan.	....	....	80
Lucas	Telegraphic and printing apparatus..........	....	....	11 Nov.	20
Lund	Propelling	30 April	....	....	360
Lyall	Public carriages	26 April	....	....	360
M'Dowall	Time keepers	10 April	....	....	299
M'Gavin	Steam boilers, furnaces and fireplaces	.....	29 Jan.	....	198
M'Nab......	Stretching and drying textile fabrics	....	6 June	....	420
Marnas........	Indigo	....	2 Dec.	....	19
Marsden	Boots and shoes	31 Jan.	....	....	100
Masirata	Motive power	18 Feb.	17 Feb.	....	160,198
Massiah	Marble and stone	....	7 Feb.	....	198
Mather and Edmeston ..	Scouring, finishing, and stretching fabrics	....	20 Dec.	....	20
Mathers and Kaselowsky	Washing, steaming, and dyeing fabrics	....	21 Nov.	....	19
Matthews	Sizing paper	....	22 Nov.	8 Feb.	19,199
Mead	Gas and water meters....	21 Jan.	....	....	80
Mein	Treating sheeps' fleeces on the animals......	....	20 Nov.	....	19

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Mellish	Admitting and excluding light, reflectors and decorating furniture	7 May	....	....	380
Melville	Weaving and printing carpets............	11 Jan.	6 Dec.	....	60,19
Menotti	Waterproofing cotton, linen, &c..........	27 Dec.	....	....	19
Miller	Distilling and rectifying..	....	....	30 Oct.	20
Milligan	Ornamenting cloth fabrics	26 April	....	....	360
Millward	Electro-magnetic and magneto-electric apparatus............	28 Feb.	....	....	199
Milner........	Boxes and safes	3 March	26 March	....	199,339
Milnes and Pickstone..	Spinning, doubling and weaving	11 Jan.	20 Jan.	....	60,139
Minton and Hoffstaedt..	Faces or dials for clocks, watches, &c........	17 March	....	....	240
Monatis	Hydraulic syphon	23 Feb.	7 Feb.	....	180,199
Morand	Stretching and drying fabrics	30 Jan.	29 Jan.	....	100,198
Morewood and Rogers....	Coating or covering metals	....	30 April	....	439
Morey	Dressing, cutting, and shaping stone	10 May	....	....	399
Morley........	Decomposing water......	....	....	7 Feb.	199
Motte	Portmanteaus	2 April	....	....	279
Mowbray......	Weaving	24 March	....	....	259
Muntz	Furnaces..............	18 Jan.	....	....	80
Murdoch	Preserving substances....	30 Jan.	....	....	100
Murray	Saddlery and harness....	10 March	....	....	220
Napier and Napier	Separating matters......	....	2 Dec.	....	19
Nasmyth and Barton....	Printing calicoes........	....	24 Dec.	....	120
Nasmyth and Minton ..	Tiles, bricks, &c........	26 April	....	....	360
Newell	Locks	15 April	....	....	319
Newton	Metal shutters..........	27 Dec.	....	...	19
Newton	Caoutchouc............	....	27 Nov.	....	19
Newton	Coating for metal, plaster, wood, &c....	....	9 Dec.	....	19
Newton	Looped and woven fabrics.	30 Jan.	14 Feb.	....	100,199
Newton	Electric telegraphs......	3 Feb.	....	....	119
Newton	Cutting and dressing stone	....	23 Dec.	....	120
Newton	Iron hurdles, or fences ..	....	23 Dec.	....	120
Newton	Milking animals	10 Feb.	....	....	139
Newton	Ice and refrigerating	....	11 Feb.	....	199
Newton	Zinc..................	....	....	22 Jan.	199
Newton	Bedsteads and sacking bottoms	28 Feb,	....	....	199
Newton	Buttons, knife handles, &c..............	4 March	.....	....	199
Newton	Woven and felted fabrics..	3 May	....	....	380
Newton	Generating and condensing steam..........	8 May	....	....	380
Newton	Carbonizing coal, purifying gas, &c.......	27 May	....	....	439

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Nicholls	Giving motion to machinery	4 April	....	....	340
Nickels	Woollen and other fabrics	....	19 June	....	520
Norman	Cooking and boiling apparatus..........	8 Jan.	....	....	80
Norris.......	Railways, bridges, and locks	10 Feb.	10 Feb.	....	139,199
Onions........	Spinning machinery	7 Feb.	....	....	119
Onions........	Steel..................	7 Feb.	....	....	119
Oxland and Oxland....	Sugar	15 May	....	....	400
Pace........	Bedsteads, couches, chairs, &c..........	21 Jan.	....	....	80
Palmer........	Candles and wicks.......	....	....	11 Nov.	420
Parker......	Opening, cleaning and preparing fibrous substances	3 June	....	....	460
Parkes	Separating silver........	24 June	....	....	519
Parsons	Cranes and railways	19 May	....	....	20
Pattinson......	Oxichloride of lead......	18 Feb.	....	....	160
Pauwells and Dubochet..	Coke and gas	....	....	11 Nov.	20
Pegg........	Corrugated surfaces on leather	29 May	....	....	439
Percy and Wiggin....	Metallic alloys..........	13 Jan.	....	....	40
Perkins	Railway axles and boxes..	5 Feb.	....	....	119
Perkins	Constructing and heating ovens..........	11 Feb.	....	....	140
Pettitt	Glass, furnaces and annealing kilns........	....	22 Nov.	....	19
Pittar	Umbrellas and parasols...	....	....	5 March	300
Pons........	Roads, ways, pavements, &c.	17 Feb.	....	....	160
Potter	Extension, Spinning machinery	21 Dec.	....	....	439
Prideaux	Steam generators and condensers, fireplaces and furnaces	28 Dec.	....	....	19
Puckridge	Ornamenting furniture....	17 April	....	....	319
Pulvermacher.	Galvanic batteries, electric telegraphs, &c ..	....	28 Nov.	....	19
Pyke	Leather, and boots, and shoes	3 May	....	....	380
Radley and Meyer....	Fatty, oleaginous, resinous, bituminous and cerous bodies.......	....	22 Nov.	7 Dec.	19,20
Reed	Saddlery and harness....	10 Feb.	....	....	139
Rees..........	Fuel..................	18 Jan.	....	....	80
Remond	Metallic tubes..........	26 Feb.	....	....	180
Reynolds	Playing cards..........	29 May	....	....	439
Richardson	Life-boats	22 Feb.	7 March	....	180,299
Richardson ..	Dyeing and cleaning piece goods	31 March	....	....	279
Ridley and Edser	Safety hinge and burglar detector	24 March	....	....	260
Riepe	Refining steel..........	....	12 Feb.	....	199

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Roberts	Yarns	10 March	13 March	....	220,299
Robertson	Musical instruments	24 April	....	....	340
Robertson and Glover	Rolling and laminating metals	20 March	....	....	240
Robinson	Separating corn from straw	11 Jan.	....	....	60
Robinson	Sewing machine	7 Feb.	....	....	119
Rogers	Peat, fuel, and charcoal	....	....	7 Feb.	199
Rose	Steam generators	3 May	....	....	380
Ross	Combing wool	13 March	....	....	220
Rotch	Centrifugal apparatus	18 Feb.	....	....	160
Rotch	Saltpetre	....	3 Feb.	4 Feb.	198,199
Samuelson	Cutting turnips	23 Jan.	....	....	80
St. John	Compasses, velocimeters, &c.	27 Dec.	18 Dec.	28 Mar.	19,19 439
St. John	Soap	21 Jan.	15 Jan.	24 Jan.	80,139 199
Schroder	Sugar	15 April	....	....	319
Shaw	Cleaning and preparing wool	5 Feb.	....	....	119
Shaw	Railways	....	7 Feb.	....	198
Shepard	Electro-magnetic apparatus	....	22 Jan.	7 Feb.	139,199
Shepherd and Button	Electric telegraphs	....	....	15 April	439
Sievier	Weaving and printing	21 Jan	....	....	80
Sievier	Weaving and printing	29 May	....	....	439
Six	Bleaching flax and hemp	24 March	....	....	259
Slate	Steam engines and boilers, passages and valves	27 May	....	....	439
Slater and Slater	Stretching and opening textile fabrics	28 Dec.	23 Jan.	....	19,198
Smith	Steam engines, feeding boilers, &c.	....	4 March	....	299
Smith	Locomotives, engines and carriages	3 May	....	....	380
Smith and Phillips	Heating, ventilating and cooking by gas	24 April	....	....	340
Smith and Smiths	Winding, weaving, cutting and printing	14 May	....	....	399
Stephens	Threshing machinery	10 Feb.	28 March	....	139,339
Stirling	Metallic sheets, coating metals, &c.	31 Jan.	....	....	100
Stones	Safety paper for banker's cheques, &c.	24 Feb.	7 March	25 Mar.	180,299 439
Stones	Peat and chemical apparatus	15 April	....	....	319
Stopporton	Propelling, steam engines and pumps	....	31 Jan.	....	198
Talbot	Photography	12 June	....	....	480
Tate	Dwelling-houses, buildings, vessels, &c.	22 May	....	....	439
Tatham and Cheetham	Steam engines, and generators, &c.	2 Jan.	....	....	40
Taurines	Measuring the working of engines	16 Jan.	....	....	60
Taylor	Dress pins, fastenings and ornaments	....	11 Dec.	....	19

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Taylor	Carbonates and oxides of barytes, and strontia, sulphur and sulphuric acid.	15 March	19 March	2 April	239,300 439
Thomson	Hydraulic machinery and steam engines ..	....	....	10 Jan.	139
Thorneycroft ..	Crank axles............	....	2 Dec.	....	19
Thomas	Calculating machine	10 Feb.	25 March	10 Mar.	139,339 300
Tupper and Normandy..	Galvanized iron.........	12 Feb.	....	....	160
Turner and Hardwick..	Constructing and setting boilers.............	....	20 Nov.	....	19
Ullmer........	Printing presses	12 Feb.	....	....	160
Velcke........	Grinding.................	....	....	13 Nov.	20
Vidie	Air, steam, gas and liquid meters	....	8 Jan.	14 Dec.	139,20
Walker........	Metallic tubes...........	24 March	....	....	259
Watson	Sails, rigging, and ships' fittings............	16 Jan.	3 Feb.	28 Mar.	60,198 439
Webley.......	Boots and shoes, water-proofing, &c........	30 April	....	....	360
Webster	Carriage and other springs	11 Feb.	5 Feb.	....	140,198
Weild	Turning and burnishing..	11 Feb.	10 Feb.	....	139,199
Wicksteed	Manure...............	24 Feb.	19 Feb.	26 Feb.	180,199 300
Wilkins	Labels or tickets	13 May	....	....	309
Wilkins	Railway buffers	29 May	....	....	439
Willis	Organs.................	28 Feb.	....	....	199
Wilson........	Alum and ammonia	....	14 Feb.	....	199
Wimshurst ..	Steam engines, propelling, and ship building	....	12 May	....	439
Wood	Figuring and ornamenting fabrics	24 Feb.	4 Dec.	24 Dec.	180,519 139
Woodcroft	Propelling vessels	....	21 Feb.	....	199
Woods and Winfield ...	Bedsteads and couches ..	24 March	....	....	260
Wragg	Railway and other carriages	26 April	....	....	360
Young	Bituminous mineral substances...........	....	....	1 Feb.	199

INDEX.

TO THE FIFTY-FOURTH VOLUME.

Abdominal supporters, Brooman's patent improvements in, 117
Acid, hydrochloric, Gossage's patent improvements in obtaining, 76
——, sulphuric, Gossage's patent improvements in concentrating, 517
Adorno's patent improvements in the manufacture of cigars, 115
Advent of the Arts, by Mr. Commissioner Ewbank, 132
Aeronautics, journal of the ascent of MM. Barral and Bixio, 174
Ainslie's patent improvements in the manufacture of bricks and tiles, 458
Agricultural machines, Tuxford's patent, 38; Hornsby's, 38; Crosskill's, 159; Cornes's, 251; Bendall's, 438; Blakemore's, 457; Brooman's, 417, 482
Allan's patent improvements in electro-telegraphy, 416
Allemand's patent improvements in lighting, 415
Alum, Spence's patent improvements in the manufacture of, 412; Wilson's, 477; Gossage's, 517
Amberger's patent improvements in propelling carriages, and in magnetic brakes, 206
America, steam navigation in, 256
American patents, recent, 53, 78
———— swing gate, 233, 287
———— transatlantic steamers, 187, 374
Ammonia, Spence's patent improvements in obtaining, 412; Wilson's, 477
Anderson's patent improvements in spectacles, 457
Anhydrous steam; Mr. Frost's experiments, 33, 293, 428, 473; Dr. Haycraft on, 47; Mr. Cheverton's Notes, 172, 205, 249, 275
Animal magnetism, Dr. Gregory's letters on, 364
Architecture, naval: new method of finding the displacement, 262; Russell's wave line theory, 268; Dr. Woolley on the received methods of calculating displacement, 347, 423, 451; White and Griffiths's Treatises, 404, 431, 444, 465, 483; Fincham's history, 347, 423, 451
Armstrong and Gilbert's improvements in working gutta percha, 53
Ashe's patent nautical instruments, 414
Association of Patentees; plan of Patent Law Reform, 9
Assurances, survivorship, new tables of the value of, 48
Atmospheric resistance, the laws of, by Mr. J. Potter, 491
Auld's patent improvements in steam engines and boilers, 515
Ayliffe's plan for lighting lamps of great height, 130

Babington's, Dr., patent improvements in preventing incrustation in steam boilers, 379
Bachhoffner and Defries's patent improvements in lighting and heating, 519
Baddeley's improvements in the manufacture of ornamental earthenware, 338
Baddeley's, Mr. W., Report of London Fires in 1850, 383; Every Man his own Fireman, 390
Bain's electric telegraph in France, 109
Baldwin and Collier's patent improvements in the manufacture of carpets, 498
Ball, the conical-shaped, and the laws of atmospheric resistance, 491
Ball's patent improvements in heating baker's ovens, 413
Ballasting vessels, Cochrane and Francis's improvements in, 216
Banck's patent improvements in the manufacture of paper, 456
Barber's patent improvements in the manufacture of reels, and desk and wafer seals, 458
Barclay's patent improvements in blast furnaces, smelting ores, steam blowers, rotary engines, and fans, 215
Barlow's patent improvements in spinning machinery, 336
Barometer, portable, Harris's patent, 509
Bateman's patent improvements in life-boats, 377
Beart's patent improvements in the manufacture of bricks and tiles, 319
Beasley's registered chicory cutting machine, 162
Beattie's patent improvements in steering vessels, 216
Beaumont's gloss-producing compound, 78
Bedsteads, metallic, Papps's patent improvements in, 479
Beetson's patent improvements in waterclosets, pumps, and cocks, 97
Bell's patent improvements in waterclosets, drains, and gas and air traps, 99
Bentham, Brigadier-General Sir Samuel; diagonal bracing, 56, 70; tubular fire-irons, 56; hollow breakwater, 57; hanging railroads, 268; fishing nets, 268 mallets, 269; masts, 269; felloes, 270; obtaining fresh water at sea, 270; rational toys, 494
Bernard's patent improvements in pneumatic springs, buffers, pumps, and stuffing boxes, 298
Bernard and Dureuille's patent improvements in the manufacture of boots and shoes, 475
Bessemer's patent improvements in figuring and ornamenting surfaces, 77, 83; centrifugal machines and sugar manufacture, 136
Bill's extension of Horner's method, 113, 162, 5·2
Birdseye's method of preparing cream, 53
Biscuit, meat, Borden's, 255
Black's patent folding machine, 396
Blakemore's patent improvements in ploughs, 457
Blast furnaces; Sir F. C. Knowles, on the form of the interior of, and the descent of their charges, 166; Barclay's patent, 215; Houldsworth's, 277
Blasting, Liebhaber's patent improvements in, 415
Bleaching, Chevalier Claussen's patent improvements in, 142
Blinds, window, Hurt's patent improvements in, 457; Bunnett's, 513
Blowers, steam, Barclay's patent direct action, 215
Boats, life, Laird's patent, 16; Firmin's buoyant masted, 331
Boggett and Smith's patent improvements in lighting and heating, and in rotary engines, 282, 290
Boilers, hot water, Garton and Jarvis's convolute, 270
Boilers, steam: Colegrave's patent feeding apparatus, 37; Pim's tubular, 38; Gray's feeding apparatus, 39; Hornsby's (agricultural), 39; Prosser's feed apparatus and tube cleaning process, 196; Newton's improvements, 196; Smith's feed apparatus, 218; Grant's, 342; Babington's preventing incrustation, 379; Nasmyth's absolute safety valve, 430, 472; Mr. Fairbairn, on the construction of, and the causes of their explosion, 436, 453, 507; Turner's improvements in heating, 496; Johnson's, 499; Auld's, 515
Bolters, Foot's patent, 17
Bolts, Bower and Fortune's improved machinery for manufacturing, 97; Woodbridge's, 218
Bookbinding, Starr's patent improvements in, 18

Book-case, safety, Mr. McGregor's, 131
Booth's improvements in refining gold, 54
——— patent improvements in obtaining motive power, 59
Booth's (J. R.) patent improvements in the manufacture of gas, 413
Boots and shoes, Young's registered rotary cleaner, 171
———, Bernard and Dureuilles's patent improvements in the manufacture of, 475
Borie's patent improvements in the manufacture of bricks, 457
Borland's patent improvements in weaving machinery, 370
Bower and Fortune's improved machinery for manufacturing screws, bolts, rivets, and nails, 97
Bradford's patent locks and fastenings, 78, 89
Brickmaking at Roorkhee, with Ransome and Parson's machine, 193
Bricks, Haddan's patent improvements in, 39; Beart's, in the manufacture of, 319; Borie's, 457; Ainslie's, 458
Bridges, suspension; the Victoria, 35; the Niagara, 73
Brisbane's patent improvements in looms, 258
Brooman's patent improvements in abdominal supporters, 117; water purifying processes, 242; railways, 396; agricultural machines (American corn reaper), 477, 482
Brougham's, Lord, Patent Law Amendment Bill, 279, 291
Brown's patent improvements in making metallic casks, 77
——————— pumps, 419
Browne's patent improvements in disinfecting fœcal matters, 314
Browne's patent improvements in weaving and preparing fibrous materials and imprinting woven fabrics, 358
Bruce's patent rotary engine, 179
Buffers, Melville's patent spring, 96; Bernard's hydro-pneumatic, 298
Bunnett's patent improvements in doors, window shutters, and blinds, 513
Burch's patent improvements in printing carpets and rugs, 278
Burmese ware, 52
Burnet's processes for purifying water, 242.
Burnishing machinery, Wield's patent improvements in, 497
Burt's patent improvements in window blinds, 457
Bury's patent improvements in preparing, spinning, and doubling fibrous materials, 317; cleaning, spinning, doubling, and throwing raw silk, 318
Buttons, Williams's patent improvements in the manufacture of, 338; Rowley's, 458

Cadby's patent improvements in pianofortes, 136
Cameo cutting, 52
Calico printing, Keates' patent mode of manufacturing rollers and cylinders for, 159; Nasmyth and Burton's improvements, 257
Canal navigation, Watt's patent improvements in, 219; Slate's, 376
Candles, Palmer's patent improvements in the manufacture of, 398
Cannon, Lancaster's patent improvements in, 39; Melville and Callow's, 134
Carbonic acid gas engine, Professor Saloman's, 259
Carding fibrous substances, Ritchie's patent improvements in, 258; Harding's, 337; Christie's, 398
Card making machinery, Harding's patent, 337; Mason and Collier's, 497
Carnell and Hosking's treble beat hydraulic valves, 142
Carpenter's improvements in preparing wheat for grinding, 54
Carpenter's, Captain, patent duplex propeller and rudder, 462
Carpets, Newton's patent improvements in manufacturing, 259; Crossley, Collier and Hudson's, 277; Burch's, 278; Wood's, 317; Baldwin and Collier's, 498
Carriages, Haddan's patent improvements in railway, 39; Melville's, 96; Dunbar's patent method of suspending, 97; Sir J. S. Lillie's improvements in propelling, 198; Fuller's landau, 202; Amberger's magnetic propulsion, 298; De Nanteuil's improvements, 377; Rock's, 412, 422; Franklinsky's public, 475; Laurie and Marner's perchless, 502
Cartridges, Elmslie and Simpson's patent, 457
Carts, Hazeldine's patent improvements in, 99
Case waterwheel, Thomson's patent, 42, 58
Cask making machinery, Rosenborg and Montgomery's patent, 1; Hamilton's, 277
Casks, metallic, Brown's patent improvements in making, 77; Clare's, 397
Castors, Kane's patent improvements in, 136; Hinley's, 475
Cements, Spence's patent improvements in, 412; Newton's, 417
Centrifugal machines, Bessemer's patent improvements in, 136
Centrifugal pump regulator, Thomson's patent, 58, 65
Cesspools, Bell's patent improvements in, 99
Chabert's patent improvements in washing and drying fabrics, 459
Chairs, reclining, Kane's patent improvements in, 136
Chameroy's patent improvements in paving, 177
Charcoal, Rogers's patent improvements in the manufacture of, 258; Sir F. C. Knowles's, 399; Green's, 518
Cheverton, Mr. B., on Paine's light and Frost's "stame," 172, 205, 275
Chicory cutting machine, Beasley's registered, 162
———, manufacture of, Duckworth's patent improvements in the, 414, 442
Chimney pots, Slate's patent, 378
Christen's patent improvements in cylinder printing, 258
Chromic salts, Swindell's patent improvements in manufacturing, 415
Cigars, Adorno's patent improvements in the manufacture of, 115; Huddart's, 197
Clark and Mapple's patent improvements in electro-telegraphy, 414
Claussen's, Chevalier, flax cotton, 32, 192; patent improvements in bleaching, in the preparation of fibrous materials, and in yarns and felts, 142
Cleaning grain and seed, Martin's patent improvements in, 415; Royce's, 514
Cleaning raw silk, Bury's patent improvements in, 318
Clock, electric, Shepherd's, at the Great Exhibition, 212
Clocks, hydraulic, Tiffereau's patent, 299
Clod crushers, Tuxford's patent, 38
Cloth, Beaumont's compound for producing a gloss on, 78; Read and Cotter's fulling machinery, 79; Edmond's, 95; Nickels's, 458
Cochrane and Francis's patent improvements in propelling, steering, and ballasting vessels, in pistons, firebars for furnaces, and sleepers for railways, 216
Cockle, James, Esq., M A., Barrister-at-Law; Notes to Mr. Harley's papers on impossible equations, 28, 66, 185, 215, 402
Cocks, Beetson's patent improvements in, 97
Cocoa-nut oil, concrete, 195
Colegrave's patent slide-valves, locomotives and boiler feeding apparatus, 36
Colling's "Gothic Ornaments," review, 13
Colours, fixing on fabrics, Johnson's patent improvements in 339, 356
Combing wool, Harding's patent improvements in, 337
Commodes, Everest and Osborne's patent, 478
Compasses, mariners', Dent's improved, 77; Mortimer's, 478
Concentrating sulphuric acid, Gossage's patent improvements in, 517
Condensers, steam engine, Pirsson's patent, 102; Leroy's, 118
Condensing smoke, Rodham and Hoblyn's patent improvements in, 514
Connop's patent improvements in melting, moulding, and casting sand, 58
Coat's improvements in the manufacture of reels, 417
Cookery, hints on the economy of, 271
Cooking apparatus, Dyke's registered portable, 250

Copper, Gossage's patent improvements in extracting, 76; Swindell's, 415
——, salts of, Gossage's patent improvements in obtaining, 517
Corn-cleaning machines, Millington's patent, 350; Martin's, 417
—— reaping machines, American, patent (Brooman's), 477, 482
Cornes's registered universal plough, 251
Cow milking apparatus, India rubber, 259
Cowper's patent improvements in the manufacture of files, 516
Cranes, tubular, Mr. Fairbairn's patent, 382
Craufurd, A. Q. G. Esq. M.A., on the principles of hydrodynamics, 107
Crawford's patent machinery for drying paper, 59
Cream, Birdseye's method of preparing, 53
Crosskill's patent improvements in mills and agricultural machines, 139; registered wheel nave, 210
Crossley, Collier, and Hudson's patent improvements in manufacturing carpets and printing yarns, 277
Cross's patent improvements in manufacturing textile fabrics, 218
Crushing machinery, White's patent, 119, 122
Cunningham's patent reefing apparatus, 215, 458
Currant cleaning machine, Weatherley's registered, 148
Cutting glass, Thomson and Mellish's patent improvements in, 179
Cutting machines, Phillips's patent (turnip), 37; Beasley's (chicory), 162; Newton's (type), 197; (stone), 514; Bendall's (turnip), 438; Nind's improvements in, 516
Cylinder printing, Christen's patent improvements in, 258; Nasmyth and Barton's, 257
Cylinders, Keates's patent mode of manufacturing, 139; Nasmyth and Barton's, 257

Daguerreotypes, multiplication of, 252
Davidson's patent lime kilns and furnaces, 377
Davies, T. S., Esq., F.R.S., F.S.A., &c., death and memoir of, 33
De Nanteuil's patent improvements in propelling carriages, 377
Dent's patent improved mariners' compasses, 77
Designs for articles of utility registered, 20, 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, 300, 320, 340, 360, 380, 400, 420, 440, 460, 480, 500
Dick's patent improvements in the manufacture of steel and gas, 177
Digging machines, Thompson's patent, 137
Dilatation, forced, of liquids, phenomena of the, 71
Discharging cargoes from ships, Laird and Cowper's patent improvements in, 419
Disinfecting fœcal matters, Browne's patent improvements in, 314
Distance register for cabs, Maughan's, 450
Dixon's patent improvements in making moulds for casting metals, 359
Docks, Wild's patent improvements, in floating and graving, 158; Scott's, 399
Doors, Bunnett's patent improvements in, 513
D'Orville and Partington's patent improvements in finishing yarns, 515
Doubling machinery, Bury's patent, 317, 318; Christie's, 398; Platt's 459
Draining land, Fowler's patent improvements in, 337
Drains, Bell's patent improvements in, 99
Drawing frame regulator, Hayden's patent, 278
———— machinery, Harding's patent, 337
Dredge's taper suspension bridges, 35
Dressing flour, Millington's patent improvements in, 350
———— grain and seeds, Millington's patent improvements in, 350; Martin's, 417; Royce's, 514
Dressing piece goods, Ripley's patent improvements in, 419
Dress pins, fastenings and ornaments, Rowley's patent improvements in, 458; Taylor's, 517
Drying paper, Crawford's patent machinery for, 59
——— woven fabrics, Mather's and Kaselowsky's patent improvements in, 379; Chabert's, 459
Duckworth's patent improvements in the manufacture of chicory, 414, 442
Dunbar's patent method of suspending carriages, 97
Dunn's patent improvements in traversing trucks, turn-tables, presses, and pumps, 418
Dwelling-houses for the poor, 258
Dyeing yarns, Newton's patent improvements in, 259; Warmont's, 377; Kurtz's, 419
Dykes's registered portable cooking apparatus, 250

Earth, rotation of the, Foucault's ocular demonstration, 325, 329, 373, 374; remarks on, by Mr. Sylvester, 328; Professor Young, 352, 372, 392; Dr. Henderson's geotropescope, 471; effect on projectiles, 353, 474, 495, 506
Earthenware, ornamental, Baddeley's improvements in the manufacture of, 338
Eccles's patent improvements in looms, 258
Edmonds's patent woollen cloth, 95
Education and food questions—their effect on skilled industry, 202
Education, industrial, 23, 55, 110; of mechanics' daughters, 234
Edwards, Ansell and Heyns's, patent rotary engines and pumps, 398
Electric clock at the Great Exhibition, Shepherd's, 212
———— light, Staite's, at Manchester, 410
Electro coating metals, Steele's patent improvements in, 134
——— magnetic light and heat producing machines, Shepard's patent, 358, 362, 410
———— ———— motive engines, Professor Page's, 214, 313, 375, 410; Shepard's patent, 358, 362, 410
———— telegraphy; Mr. Bains' telegraph in France, 109; application of the Electric Telegraph Co., for extension of patent, 131; in Mexico, 214; Clark and Mapple's patent improvements, 414; Allan's, 416; first idea of, 429; Shepherd and Button's improvements (submarine), 438
———— types, surface printing, 352
Elmslie and Simpson's patent improvements in sheathing ships, and in cartridges and fireworks, 457
Engraving, English gem, 51
Equations, algebraic, Mr. Bill's extension of Horner's method of approximation to the unreal roots of, 113, 162, 502
———— impossible, on, by Robert Harley, Esq., 28, 66, 185, 215, 402
Erard's patent improvements in pianofortes, 219
Etchings on steel, Dr. Pring's process, 253
Everest and Osborne's patent commodes and water-closets, 478
Ewbank, Commissioner, on "the Advent of the Arts," 132; what is yet to be done by them, 195; discoveries and improvements endless, 275; dignity of mechanical pursuits, 276
Explosive compounds, Melville and Callow's, patent, 134
Extension of patent, application of the Electric Telegraph Company for, 131
Exhibition, The Great, Shepherd's electric clock, 212; opening of, 355; the official catalogue, 380, 394; Warlock's lead-smelting machinery, 394; artificial ultramarine, 395; Russell and Robertson's patent white lead, 396
Evans's improved rope-making machine, 79

Fabrics, textile: Mather and Edmeston's patent scouring, finishing, and stretching machinery, 218; Crosse's improvements in the manufacture of, 218; Paterson's finishing, 239; Johnson's printing, 339, 356; Browne's printing, 358; Mercer's preparing, 358; Jacobs' printing, 359; Tatham

and Cheetham's manufacturing, 377; Mather and Kaselowsky's washing, drying, and finishing, 379; Nickels' woollen, 438; Wood's figuring and ornamenting, 497
Fairbairn and Hetherington's patent improvements in preparing, spinning, and weaving machinery, and in making moulds for casting, 116
Fairbairn, W. Esq., C. E.; his patent tubular cranes, 382; on the construction of steam boilers and the causes of their explosions, 436, 453, 507
Fairbank's improved printing machines, 78
Falling bodies, Oerstedt's experiments on, 392
Fans, Barclay's patent improvements in, 215
Fastenings, dress, Bradford's patent improvements in, 78; Rowley's, 458; Taylor's, 517
Fœcal matters, disinfecting, Browne's patent improvements in, 314
Felts, Chevalier Claussen's patent improvements in, 142
Fences, Newton's patent improvements in, 499
Fibrous materials, Hill's improvements in preparing, 59; Fairbairn and Hetherington's preparing, spinning, and weaving, 116; Chevalier Claussen's improvements in the preparation of, 142; Illingworth's preparing, 197; Saul's spinning, 217; Paterson's preparing and spinning, 239; Ritchie's preparing and carding, 258; Bury's preparing, spinning, doubling, and twisting, 317; Barlow's spinning, 336; Harding's heckling, carding, combing, and drawing, 337; Browne's preparing, 358; Mercer's preparing, 358; Tatham and Cheetham's preparing and spinning, 377; Christie's preparing, carding, spinning, doubling, twisting, knitting, and packing, 398, Platt's spinning and doubling, 459; Mason and Collier's preparing, 497
Figuring and ornamenting surfaces, Bessemer's patent improvements in, 77, 83; Wood's, 497
Files, Cowper's patent improvements in the manufacture of, 516
Fincham's "History of Naval Architecture," 347, 423, 451
Firmin's, Mr. G., buoyant masted life-boat, 331
Fishing-nets, notes on the manufacture of, in Russia, 269
Fireworks, Elmslie and Simpson's patent improvements in, 457
Fires, London, in 1850, Mr. W. Baddeley's report of, 383
Filters, Baird's patent, 17; Forster's, 17; Price and Whitehead's, 257; Murray's self cleansing tubular, 293
Finishing woven fabrics, Mather and Edmeston's patent improvements in, 218; Paterson's, 239; Mather and Kaselowsky's, 379; Ripley's, 419; Watson's, 459;
Finishing yarns or threads, D'Orville and Partington's patent improvements in, 515
Firearms, Lancaster's patent, 39; Melville and Callow's, 134
Fireproof partitions, and the late fires, 191
Fixing glass, Thomson and Mellish's patent improvements in, 179
Flax breaking machine, Plummer's, registered, 262
—— cotton, Chevalier Claussen's 32, 142, 192
—— dressing holder, Martin's registered, 330
Floating docks, Wild's patent, 138
Flooring ram, Mayes's registered, 490
Flour-dressing machines, Millington's patent, 341
Folding machine, Smith's patent, 75; Black's, 96
Fontainemoreau, Mr. on Gardissal's patent, 18
Foot's patent improvements in bolters, 17
Forster's patent filters, 17
Foucault's experiments: ocular demonstration of the rotation of the earth, 325, 329, 373, 374; letter of Mr. Sylvester, 328, 359; of Professor Young, 352, 372, 392; Dr. Henderson's geotropescope, 471
Fowler's patent improvements in steam engines and draining land, 337
Franklinsky's patent omnibuses and public carriages, 475
Freché's patent improvements in obtaining power, 137
Freezing, Kingsford's patent improvements in, 36; Dr. Gorrie's process, 87; Newton's improvements in, 178
Frost, Mr. James, experiments on steam, 32, 47, 172, 205, 249, 275, 295, 428, 473
Fuel, Rogers's patent improvements in the manufacture of, 258; Wood's, 476: Green's, 518
Fuller's registered landau, 202
Fulling cloth, Read and Cotter's improvements in, 79
Fulljames's patent lifting jacks, 17
Fulton's *bateau plongeur*, 211
Funnel, Marsden's registered syphon, 410
Furnaces, Cochrane and Francis's patent firebars for, 216; Rennie's improvements, 217; Davidson's, 377; Williams's, 477
Furnaces, blast: Sir F. C. Knowles, on the form of the interior of, and the descent of their charges, 166; Barclay's patent, 215; Houldsworth's, 277
Fyfe's sheep washing apparatus, 259

Gage's patent tissue bandages and wafers, 459
Galvanized type, Dr. Newton's, 512
Gardissal's patent, 18
Garton and Jarvis's convolute hot water and steam boiler, 270
Gas holders, Hancock's india-rubber, 79
—— manufacture of, Dick's patent improvements in the, 177; Booth's, 413
—— meters, Medhurst's patent improvements in, 413
—— traps, Bell's patent improvements in, 99
—— retorts and furnaces, Rennie's patent, 217
—— water, Shepard's patent, 129
Gates, American swing, 233, 287; the "Kilmory x x," 289
Gem engravers, English, 51
Gems, fictitious, processes of manufacturing and setting, 50
Geometrical theorem, important, by T. T. Wilkinson, Esq., 10
Geotropescope, Dr. Henderson's, 471
Glass, Thomson and Mellish's improvements in cutting, staining, silvering, and fixing, 179
Gloss producing compound, Beaumont's, 78
Gold refining, Booth's improvements in, 54; M'Culloch's, 54; Newton's, 177
Gordon, Lieut. W., R.N., on screw propelling, 349
Gossage's patent improvements in obtaining copper, silver, hydrochloric acid and sulphate of soda, 76; concentrating sulphuric acid, manufacture of alum, sulphate of alumina, and salts of iron and copper, 517
"Gothic Ornaments," Colling's, review, 13
Grant's patent steam boiler, 342
Grain, preparing for grinding, Carpenter's improvements in, 54; Millington's 350; Martin's, 417
Granville's, Earl, Patent Laws, Reform Bill, 333
Graving docks, Wild's patent improvements in, 158
Green's patent improvements in the preparation of peat, 518
Gregory's, Dr., "Letters on Animal Magnetism," 364
Grinding, Carpenter's method of preparing grain for, 54; Royce's improvements in, 514
Gun barrels, twisted, Rose's patent improvements in manufacturing, 339
Gun carriages, Howels' patent, 298
Gurlt's patent improvements in extracting silver, 316
Gutta percha, manufacture of, Armstrong and Gilbert's improvements in, 53
Gwynne's patent double acting balanced pressure water wheel, 134, 322

Haddan's patent improvements in carriages, wheels, and brickwork, 39
Haley's patent improvements in looms, 417
Hall's improved stop motion for looms, 54
Hamilton's patent cask making machinery, 277
Hancock's india rubber gas holders, 79

Harding's patent improvements in heckling, carding, combing, and drawing machinery, and in steam engines, 337
Hare's, Professor, researches on ozone, 503
Harley, R. Esq., on impossible equations, 28, 66, 185, 215, 402
Harris's patent portable barometer, 509
Haycraft, Dr., on anhydrous steam, and Mr. Frost's discoveries, 32, 47
Hayden's patent drawing frame regulator, 278
Hazeldine's patent improvements in wagons, carts, and vans, 99
Heat, theory of, by A. Trevelyan, Esq., 208
Heating, Boggett and Smith's patent improvements in, 299; Ball's, 413; Turner's, 496; Bachhoffner and Defries's, 519
Heckling machinery, Harding's patent, 337
Helbrenner's improved method of preventing air draughts, &c., 115
Helicograph, Penrose's screw, 91, 129; Penrose and Bennett's, 92
Henderson's, Dr. E., geotropescope, or instrument to show the earth's rotation, 471
Highway between the Atlantic and Pacific, proposed grand, 53
Hill's, Mr. L., process of photographing in natural colours, 273, 296, 332
Hinley's patent improvements in the manufacture of castors, 475
Hoby's patent improvements in railways, 38, 476
Hodgkinson's patent improvements in smelting, and in the manufacture of iron, 379
Holland's patent improvements in umbrellas and parasols, 197
Holl's patent improvements in steam engines, 159
Holtzapffel's "Turning and Mechanical Manipulation, vol. iii." 50
Horner's method, Mr. Bill's extension of, 113, 162, 502
Hornsby's patent agricultural machines, and steam engines and boilers, 38
Hosking's patent improvements in pumps, valves, and pressure indicators, 419
Houldsworth's patent improvements in smelting, 277
Howarth's improved machinery for raising nap, 415
Howel's patent gun carriages, 298
Huddart's patent improvements in cigars, 197
Hunt, Mr. B., on coloured photographs obtained by Mr. Hill's process, 332
Hydraulic machinery, Thompson's patent, 42, 57, 62, 126; Gwynne's, 134, 322; Nye's, 413
Hydraulic valves, Carnell and Hosking's registered treble beat, 142
Hydrochloric acid, Gossage's patent improvements in obtaining, 76
Hydrodynamics, the principles of, by A. Q. G. Crawford, Esq. M.A., 107
Hydrostatic press, Bernard's patent, 299
Hynam's patent match taper dipping frame, 117

Ice, manufacture of, by Dr. Gorrie's process, 87; Newton's improvements, 178
Illingworth's patent improvements in preparing fibrous materials, 197
Illuminating gas stove, Knowles's registered, 170
Impossible equations, Robert Harley, Esq., on, 28, 66, 185, 215, 402
Incrustation, preventing, in steam boilers, Dr. Babington's patent improvements in, 379
India rubber, Newton's patent improvements in the manufacture of, 58
——— cow milking apparatus, 259
———, portable gas holders, Hancock's, 79
Indicators, pressure, Vidie's patent improvements in, 399; Hosking's, 419
Indigo, Marnas's patent improvements in the preparation of, 499
Industrial education, 23, 55, 110, 234
——— school, design for an, 343
Industry, skilled, effect of on the education and food questions, 202
Inventions, Protection of, Act, 1851, 312
Iron, Barclay's patent improvements in the manufacture of, 215; Houldsworth's, 277; Harratt's, in rolling, 277; Hodgkinson's manufacture of, 379
——, salts of, Gossage's patent improvements in obtaining, 517

Jacks, lifting, Fulljames's patent, 17
Jacobs's patent improvements in printing fabrics, 359
Jenning's patent improvements in waterproofing, 96
"Jenny Linds," 79
Jerningham's, Captain, registered letter clip, 71
Johnson's patent improvements in fixing colours on fabrics, 339, 356
———, W. B., patent improvements in steam engines and boilers, 499
Juice expressing machinery, White's patent, 119, 121

Kane's patent improvements in reclining chairs, castors, and presses, 136
Keate's patent mode of manufacturing rollers and cylinders for calico printing, 139
Kettles, Perkins and Sharpus's registered, 271
Kingsford's patent improvements in refrigerating and freezing, 36
Knitting, Christie's patent improvements in, 398
Knowles, G. Esq., registered illuminating gas stove, 170
Knowles, Sir F. C., on the form of the interior of blast-furnaces and the descent of their charges, 166; patent improvements in the manufacture of charcoal, 399
Kurtz's patent improvements in dyeing, 419

Laird's patent improvements in life boats and filters, 16
——— and Cowper's patent improvements in loading and discharging ship's cargoes, and in building ships, 419
Lamps, method of lighting at a great height, 130
Landau, Fuller's registered, 202
Lassell's machine for polishing specula, 124
Law case, patent, the Queen v. Bessell, 375
—— practice, patent, new orders, 73, 376
—— reform, patent, 6, 29; Lord Brougham's Bill, 279, 291; Earl Granville's Bill, 333
Lead smelting machinery, Warlock's, 394
——, white, Robertson and Russell's patent, 396
Lerow's patent improvements in sewing machines, 397
Letter clip, Captain Jerningham's registered, 71
Liebhaber's patent improvements in blasting and working marble and stone, 415
Life boats, Laird's patent, 16; Firmin's buoyant masted, 331; Bateman's, 377
Lifting jacks, Fulljames's patent, 17
Light, electric, Staite's, at Manchester, 410
———, Paine's new source of, 67, 94, 114, 128, 172, 174, 182, 506
Lighthouses, Wilkins's patent improvements in, 397; pile supporter, 507
Lighting, Bogget and Smith's patent improvements in, 299; Wilkins's, 397; Allemand's, 415; Bachhoffner and Defries's, 519
——— lamps of great height, Ayliffe's plan for, 130
Lightning storms, effect of, on steam boats, 213
Lillie's, Sir J. S., patent improvements in propelling vessels and carriages, 198
Limekilns, Davidson's patent, 377
Liquids, forced dilatation of, phenomena of, 71
Lithographic press, Messrs. Napier's patent, 402
Loading cargoes, Laird and Cowper's patent improvements in, 419
Lock gates, Wild's patent improvements in, 138
Locks, Bradford's patent, 78, 89
Locomotives, Colegrave's patent improvements in, 37; Melville's, 95; Leroy's, 118; Fernihough's, 318
London Fires in 1850, Mr. W. Baddeley's Report of, 383
Longdon and Tabberer's patent improvements in the manufacture of looped fabrics, 238

Looms, Hall's improved stop motion for, 54; Fairbairn and Hetherington's patent improvements, 116; Meyer's, 137; Cross's, 218; Brisbane's 258; Eccles's, 258; Browne's, 358; Borland's, 370; Tatham and Cheetham's, 377; Christie's, 398; Haley's, 417; Shiers and Heginbotham's, 459; Platt's, 459
Looped fabrics, Longdon and Tabberer's patent improvements in the manufacture of, 238
Lucas's patent improvements in printing apparatus, 398

Mabley's patent improvements in the manufacture of soap, 297
M'Culloch's improvements in refining gold, 54
Magazines, ships', Newton's patent improvements in the construction of, 179
Magnesia, a mountain of, in California, 313
Magnetism, animal, Dr. Gregory's letters on, 364
Magneto-electric machines, Newton's (Paine's), patent, 182
Main and Brown's, Messrs., Treatise on the steam engine vindicated, 247
———'s patent printing machinery, 398
Mallets, Trattles's patent improvements in, 118; Sir S. Bentham's hollow-headed, 269
Malone's method of obtaining glass negatives, 72
Marble, Massiah's patent artificial, 135; Liebhaber's, improvements in working, 415
Marbles for children, 50
Marine steam engines, Messrs. Main and Brown's Treatise on, vindicated, 247
Marnas's patent improvements in the preparation of indigo, 499
Marsden's registered syphon funnel, 410; patent scissors and thimbles, 412
Martin's registered flax-dressing holder, 330
——— patent rice and grain-cleansing machinery, 417
Massiah's patent artificial marble and stone, 135
Mason and Collier's patent improvements in preparing and card-making machinery, 497
Masson's improvements in preserving vegetables, 414
Masts, notes on, by Sir S. Bentham, 269
Match dipping-frame, Hynam's patent, 117
Mathematical Periodicals, Contributions to the History of, by T. T. Wilkinson, Esq., 449, 474, 492
Mather and Edmeston's patent scouring, finishing, and stretching machinery, 218
Mather and Kaselowsky's patent washing, steaming, drying, and finishing machinery, 379
Matthews's patent improvements in sizing paper, 376
Mattresses, Papps's patent improvements in, 479
Maudslay's feathering screw propeller, 36
Maugham's distance register for cabs, 459
Mayes's registered flooring ram, 490
Meat biscuit, Borden's, 253
Medhurst's patent improvements in gas meters, 413
Mein's patent sheep dip, 479
Melville and Callow's patent improvements in fire-arms, cannons, and explosive compounds and shells, 134
Melville's patent improvements in locomotives, railways, and carriages, 95
Mercer's patent improvements in the preparation of fibrous materials and woven fabrics, 358
Metallic casks, Brown's patent improvements in, 77; Clare's, 397
Metals, coating, Steele's patent improvements in, 134; Papps's, 479: Morewood and Rogers's, 514
Metcalf's method of removing electricity from wool, 55
Meters, water, Parkinson's patent, 214
Meyer's patent improvements in looms, 137
Michiel's patent improvements in preparing potatoes for seed, 336
Millington's patent corn cleaning and flour dressing machines, 350
Mills, Crosskill's patent improvements in, 139; Bendall's, 438
Mills's patent improvements in steam engines and pumps, 78, 82
Morewood and Rogers's patent improvements in coating metals, 514
Morgan, Mr. W., on Nasmyth's absolute safety valve, 472
Morrell's patent rotary engines and pumps, 398
Mortimer's patent improvements in mariner's compasses, 478
Morton's, Dr. artificial tooth manufactory at Needham, 310
Mott's improved roadway, 78
Moulds for casting metals, Fairbairn and Hetherington's improvements in making, 116; Dixon's, 359
Murray, Professor, on river water, 194
———'s self cleansing tubular filter, 291

Nails, Bower and Fortune's improved machinery for manufacturing, 97
Nap, raising, Howarth's improved machinery for, 415
Napier and Sons' patent lithographic press, 402
Nasmyth's absolute safety-valve, 430, 472
Nasmyth and Barton's patent improvements in calico printing, and in making rollers and cylinders, 257
Nautical instruments, Ashe's patent improvements in, 414
Naval architecture; new method of finding the displacement, 262; Russell's wave line theory, 268; Dr. Woolley on the received method of calculating displacement, 347, 423, 451; Fincham's History of, 347, 423, 451; White's and Griffiths's Treatises, 404, 431, 444, 465, 483
Navigation, Indian river, wind-screw for, 190
———, inland, Watt's patent improvements in, 219; Slate's, 376
———, steam in America, 187, 256
———, submarine; Dr. Payerne's system, 211; Fulton's *bateau plongeur*, 211
Newton's patent improvements in the manufacture of india-rubber, 58; zinc and pigments, 98; gold refining, 177; ice making and refrigerating, 178; ships' magazines, 179; (Paine's) magneto-electric machine and light, 182; ships, and steam boilers, 196; type cutting, 197; weaving carpets and dyeing yarns, 259; manufacturing yarns, 317; pigments and cements, 417; steam engines, 478; wirework, 499; cutting and dressing stone, 514
Niagara suspension bridge, 73
Nickels' patent improvements in woollen and other fabrics, 458
Night lights, Palmer's patent improvements in the manufacture of, 398
Nind's patent improvements in the manufacture of sugar and in cutting and rasping canes, 516
Nye's patent improvements in steam engines, hydraulic and pile-driving machinery, 413

Oil, cocoa-nut, concrete, 195
Ommanney's patent improvements in the manufacture of steel, 515
Omnibuses, Rock's patent improvements in, 412; Franklinsky's, 475
Orde's, Sir J., "Kilmory x x" gate, 289
Ornamenting surfaces, Bessemer's patent improvements in, 77, 83
——— woven fabrics, Wood's patent improvements in, 497
Ornaments, dress, Rowley's patent improvements in, 458; Taylor's, 517
———, Gothic, review of Mr. Colling's work on, 13
Ovens, baker's, Ball's patent improvements in applying heat to, 413
Oxide of zinc, Scott's patent improvements in the preparation of, 98; Newton's, 98
Ozone, researches on, Professor Hare's, 503

Packing fibrous materials, Christie's patent improvements in, 398
——— metallic, Mill's patent, 78, 82, Cochrane and Francis's, 216; Smith's, 219; Johnson's, 499
Paddlewheel vessels, Russell's patent improvements in the construction of, 318

Page's, Professor, electro-magnetic engine, 214, 313, 375, 410
Paine's, new source of light, 67; 506; theory in explanation, 94; Mr. S. L. Freemont on, 94; evidence of Mr. Q. G. Colton, 114; effect of passing hydrogen through turpentine, 128; Mr. Cheverton on, 172; Mr. J. Swan, 174; the specification, 182
Palmer's patent improvements in candles and night lights, 398
Pape's patent improvements in pianofortes, 517
Paper, Crawford's patent machinery for drying, 59; Mathews's patent improvements in sizing, 376; Bancks's in manufacturing, 456
——hangings, Voyez's patent, 478
Papps's patent improvements in bedsteads and mattresses, 479
Parafine, Young's patent improvements in obtaining, 334
Parasols, Pittar's patent improvements in, 159; Holland's, 197
Parkinson's patent water meters, 214
Partitions, fireproof, and the late fires, 191
Pascal's patent smoke preventer and ventilator, 137
Patent inventions, publication of, 426
——— law cases, The Queen v. Bessell, 375
——— ——— practice, new orders, 73, 376
——— ——— reform,—plan of the Committee of the Society of Arts, 6; of Mr. Webster, 7; of the Association of Patentees, 9; operation of the Provisional Registration Act, 29; Lord Brougham's Bill, 279, 291; Earl Granville's Bill, 333
Patents, new English, 19, 40, 60, 80, 100, 119, 139, 160, 180, 199, 220, 239, 259, 279, 299, 319, 340, 360, 380, 399, 420, 439, 460, 480
——— ——— ———, specifications of, 16, 36, 57, 74, 95, 115, 133, 158, 178, 196, 215, 238, 257, 277, 297, 314, 334, 356, 376, 396, 412, 437, 456, 475
——— ——— ———, ———due, but not enrolled, 40, 78, 119, 379, 419, 480
———, ——, Irish, 20, 139, 199, 300, 439
———, ——, Scotch, 19, 120, 139, 198, 299, 339, 439
———, recent American, 53, 78
Paterson's patent improvements in preparing and manufacturing textile materials, and finishing woven fabrics, 239
Paving, Chameroy's patent improvements in, 178; Woods's, 456
Paxton's patent ridge and furrow roof, 97
Peat, preparation of, Rogers's patent improvements in, 258; Green's, 518
Pendulum experiment, Foucault's, 325, 328, 329, 352, 372, 373, 374, 392, 471
Penrose and Bennett's sliding helicograph, 92
———'s screw helicograph, 91, 129
Percussion tubes, Lancaster's patent, 39
Periodicals, Mathematical, contributions to the history of, by T. T. Wilkinson, Esq., 449, 474, 492
Perkins and Sharpus's registered kettles, &c., 271; double cone smoke elevator, 311
Phillips's patent turnip cutters, 37
Photography; Mr. Malone's method of obtaining glass negatives, 72; multiplication of daguerreotypes, 252; obtaining images in natural colours, Hill's process, 273, 296, 332
Pianofortes, Cadby's patent improvements in, 136; Erard's, 219; Pape's, 517
Pigments, Scott's patent improvements in the manufacture of, 93; Newton's, 98; Newton's, 417
Pile-driving machinery, Nye's patent improvements in, 414
—— supported lighthouse, destruction of a, 507
Pim's patent tubular boilers, 38
Pins, dress, Rowley's patent improvements in, 458; Taylor's, 517
Pirsson's patent steam engine condenser, 102
Pistol barrels, twisted, Rose's patent improvements in manufacturing, 339
Pittar's patent improvements in umbrellas and parasols, 159
Platt's patent improvements in doubling, spinning, and weaving, 459
Ploughs, Cornes' universal, 251; Bendall's patent, 438; Blakemore's, 457
Plummer's registered flax-breaking machine, 262
Plush hats, Watson's improvements in manufacturing, 459
Polishing specula, Mr. Lassell's machine for, 124
Porisms, on, by T. T. Wilkinson, Esq., 157
Portmanteaus, Pratt's patent, 95
Poor, the, dwelling-houses for, 253
Potatoes, preparing, for seed, Michiel's patent improvements in, 336
Potter, Mr. J., on the conical shaped ball, and the laws of atmospheric resistance, 491
Power, motive, obtaining, Booth's improvements in, 59; Freché's, 137; Amberger's, 296; Fernihough's, 318; Shephard's, 358, 362
Pratt's patent portmanteaus, 95
Preparing fibrous substances, Hill's patent improvements in, 59: Fairbairn and Hetherington's, 116; Chevalier Claussen's, 142; Illingworth's, 197; Paterson's, 239; Ritchie's, 258; Bury's, 317; Browne's, 358; Mercer's, 358; Tatham and Cheetham's, 377; Christie's, 398; Platt's, 459; Mason and Collier's, 497
Press, lithographic, Napier and Son's patent, 402
Presses, White's patent crushing and expressing, 119, 122; Kane's, 136; Dunn's, 418
Pressure indicators, Vidie's patent improvements in, 399; Hosking's, 419
Price and Whitehead's patent filters, 257
Priming preventor, steam engine, Thompson's patent, 58, 65
Pring's, Dr., steel etching process, 253
Printing woven fabrics, Keate's improvements in, 159; Nasmyth and Barton's, 257; Christen's, 258; Johnson's, 339, 356; Browne's, 358; Jacobs, 359
——— apparatus, Lucas's patent improvements in, 398
——— machinery, Fairbank's improved, 78; Main's patent, 398
——— carpets, Burche's patent improvements in, 278
——— yarns, Crossley, Collier, and Hudson's patent improvements in, 277
Projectiles, effect of the earth's rotation on, 474, 495, 506
"Propeller, Screw," Mr. R. Rawson's, 148, 223, 279
Propelling carriages, Sir J. S. Lillie's patent improvements in, 198; Amberger's, 298; De Nanteuil's, 377
——— vessels: Mr. Maudsley's feathering screw, 36; windscrew for Indian river navigation, 190; Sir J. S. Lillie's patent improvements, 198: Cochrane and Francis's, 216; Windscrews, 297; Malo's improvements, 302; Wimshurst's, 413; Captain Carpenter's, 462
Prosser's patent improvements in feeding and clearing out the tubes of steam boilers, 196
Protection of Inventions Act, 1851, 312
Provisional registrations, list of, 138, 160, 200, 240, 260, 280, 300, 320, 340, 360, 400, 420, 440, 460, 480, 500, 520
Publication of patent inventions, 426
Pump, centrifugal, regulator, Thompson's patent, 58, 65
Pumps, Mill's patent improvements in, 78, 82; Beetson's, 97; Smith's, 218; Boggett and Smith's, 282, 299: Robinson's, 397; Edwards, Ansell, and Heyns's, 398; Morrell's, 398; Nye's, 413; Dunn's, 418; Hosking's, 419; Brown's, 419
Purifying smoke, Rodham and Hoblyn's patent improvements in, 514
——— water, Brooman's (Lelong Burnet's) patent processes, 242

Railways: Hoby's patent permanent way, 38, 476; Melville's, 95; Shaw's improvements, 119; Cochrane and Francis's patent sleepers, 216; Sir Samuel Bentham's proposition for suspension, 269; Amberger's magnetic propulsion and brakes, 298; Brooman's improvements, 396; Dunn's traversing trucks and turn tables, 418

Ram, flooring, Maye's registered, 490
Randall and Saunder's patent stone-sawing machinery, 21
Ransome and Parson's patent brick machine at Roorkhee, 193
Rasping sugar canes, Nind's patent improvements in, 516
Rational toys, note by Sir Samuel Bentham, 494
Rawson's, Mr. R., "Screw Propeller," 148, 228, 279
Reaping machines, patent, American (Brooman's), 477, 482
Reclining chairs, Kane's patent improvements in, 136
Reefing apparatus, Cunningham's patent, 215, 458
Reels, manufacture of, Coat's patent improvements, 417; Barber's, 458
Refining gold, Booth's method of, 54; M'Culloch's, 54; Newton's, 177
——— steel, Reipe's patent improvements in, 476
——— sugar, Bessemer's patent improvements in, 136; Shears's, 338
Refrigerating, Kingsford's patent improvements in, 36; Dr. Gorrie's apparatus, 87; Newton's, 178
Registered designs for articles of utility, 20, 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, 300, 320, 340, 360, 380, 400, 420, 440, 460, 480, 500
Registrations, provisional list of, 138, 160, 200, 240, 260, 280, 300, 320, 340, 360, 400, 420, 440, 460, 480, 500, 520
Regulator, centrifugal pump, Thompson's patent, 58, 65
Resistance, law of, to the passage of bodies through water, 47; law of atmospheric, 491
Retorts, gas, and furnaces, Rennie's patent, 217
Reynolds, Rev. Osborne: effects of the earth's rotation on projectiles, 474, 495, 506
Rice cleansing machinery, Martin's patent, 417
Riepe's patent improvements in refining steel, 476
Rishton's patent improvements in water-closets and urinals, 119
Ritchie's patent improvements in preparing and carding wool, 258; stoves, 458
River water, Professor Murray on, 194
Rivets, Bower and Fortune's improved machinery for manufacturing, 97; Woodbridge's, 218
Robinson's patent improvements in pumps, working windlasses, and steering ships, 397
——————sewing machine, 437
Rock's patent improvements in carriages, omnibuses and springs, 412
Rodham and Hoblyn's patent improvements in condensing and purifying smoke, 514
Roadway, Mott's combined, 78
Robertson and Russell's patent white lead, 396
Rollers, Keate's patent mode of manufacturing, 139; Nasmyth and Barton's, 257
Roofing, Paxton's patent improvements in, 97
Rolling iron, Harratt's patent improvements in, 277
Ropemaking machine, Evans's, 79
Rosenborg and Montgomery's patent cask making machinery, 1
Rose's patent improvements in manufacturing twisted gun and pistol barrels, 339
Rotary engines, Bruce's patent, 179; Barclay's, 215; Boggett and Smith's, 282, 299; Fowler's, 337; Edwards, Ansell and Heyns's, 398; Morrell's, 398; theory of, 409; Wimshurst's improvements, 413
Rotation of the earth, Foucault's ocular demonstration of the, 325, 328, 329, 352, 353, 372, 373, 374, 392; Dr. Henderson's geotropescope, 571
————————, its effects on projectiles, 474, 495, 506
Rotch's (B.) patent improvements in the manufacture of saltpetre, 178
———, (T. D.) patent improvements in the manufacture of soap, 133
Rowley's patent improvements in dress pins, fastenings and ornaments, 458
Royce's patent improvements in grinding, dressing, and cleaning corn, 514
Russell's, Mr. J. S., wave line theory, 268; patent improvements in constructing paddle-wheel vessels, 318

Safety book case, Mr. Mac Gregor's, 131
——— valve, Mr. Nasmyth's absolute, 430, 472
Saltpetre, Rotch's patent improvements in the manufacture of, 178
Sand, Connop's patent improvements in melting, moulding, and casting, 58
Saul's patent improvements in spinning machinery, 217
Sawing machinery, Randell and Saunders's patent, 21
Sawsets, Trattle's patent improvements in, 118
Schiss, Dr. Emil, on Mr. Thompson's patent water wheels, 126
School, industrial, design for an 343
Scissors, Marsden's patent improvements in, 412
Scott's patent improvements in the manufacture of oxide of zinc and pigments, 98
——— patent improvements in docks and slips, 399
Scouring woven fabrics, Mather and Edmeston's patent improvements in, 218
Screw blanks, Woodbridge's patent machinery for making, 218
"Screw Propeller," Mr. R. Rawson's, 148, 223, 279
Screw propelling, Mr. Maudslay's feathering, 36; Malo's patent improvements in, 302; Note by Lieut. W. Gordon, 349
———, wind, for Indian river navigation, 190, 297
Screws, Bower and Fortune's improved machinery for manufacturing, 97
Seals, desk and wafer, Barber's improvements in manufacturing, 458
Seasoning wood on a small scale, method of, 165
Seed, preparing potatoes for, Michiel's patent improvements in, 336
Sewing machines, Wilson's, 222; Lerow's patent, 397; Christie's, 398; Robinson's, 437
Shaw's patent improvements in railways, and in working signals, 119
Shears's patent improvements in manufacturing and refining sugar, 338
Sheep dip, Mein's patent, 479
Sheep washing apparatus, Mr. Fyfe's, 259
Shells, Melville and Callow's patent improvements in, 134
Shepard's patent electro-magnetic light, heat, and motive power producing machines, 358, 362, 410
Shepherd and Button's patent improvements in submarine electric telegraphs, 438
Shiers and Heginbottom's patent improvements in weaving velvets, 459
Ship-building, diagonal bracing, first proposed by Sir Samuel Bentham, 56, 70; Newton's patent improvements in, 196; Wimshurst's, 412; Laird and Cowper's, 419
Ship's magazines, Newton's patent improvements in the construction of, 179
Shoes, Bernard and Dureuille's patent improvements in the manufacture of, 475
Signal lights, Wilkins' improvements in, 397
Signals, railway, Shaw's patent improvements in working, 119
Silk, raw, Bury's improvements in cleaning, spinning, doubling, and throwing, 318
Silver, Gossage's patent improvements in extracting, 76; Gurlt's, 316; Swindell's, 415
Silvering glass, Thomson and Mellish's patent improvements in, 179
Silvester's patent improvements in straightening, flattening, and setting hardened steel, 74
Sizing paper, Matthews's patent improvements in, 376
Slate's patent improvements in canal navigation, 376
———————————— stoves and chimney-pots, 378
Slide valves, Colegrave's patent, 37
Slips, Scott's patent improvements in, 399
Smalt, manufacture of, by C. Tomlinson, Esq., 306
Smee, Mr. A., elements of electro-metallurgy, 251; novel application in mechanics, 299
Smelting ores, Barclay's patent improvements in, 215; Houldsworth's, 277; Hodgkinson's, 379; Warlock's lead machinery, 394

Smith's patent folding machine, 76
——— improvements in steam engines, pumps, and boiler feeding apparatus, 218
Smoke condensing and purifying, Rodham and Hoblyn's patent improvements in, 514
Smoke elevator, double cone, Perkins and Sharpus's, 311
Smoke preventer, Pascal's patent, 137
Soap, Rotch's patent improvements in the manufacture of, 132; Mabley's, 297
Society of Arts Committee; plan of patent law reform, 6, 29
Soda, sulphate of, Gossage's patent improvements in obtaining, 76
Specifications of new English patents, 16, 36, 57, 74, 95, 115, 135, 158, 178, 196, 215, 238, 257, 277, 297, 314, 334, 356, 376, 396, 412, 437, 456, 475
——— due, but not enrolled, 40, 78, 119, 379, 419, 480
Spectacles, Anderson's patent improvements in, 457
Specula, Mr. Lassell's machine for polishing, 124
Speed and power, 329
Spence's patent improvements in the production of alum, ammonia, and cements, 412
Spinning machines, Fairbairn and Hetherington's patent, 116; Saul's, 217; Paterson's, 239; Bury's, 317, 318; Barlow's, 336; Tatham and Cheetham's, 377; Christie's, 398; Platt's, 459
Springs, Melville's patent, 95; Rock's, 412
Staining glass, Thomson and Mellish's patent improvements in, 179
Staite's electric light at Manchester, 410
Starr's patent improvements in bookbinding, 18
Steam, anhydrous; Mr. Frost's experiments, 33, 428, 473; Dr. Haycraft on, 47; Mr. Cheverton's notes on, 172, 205, 249, 275, 295
——— boilers: Colegrave's patent feeding apparatus, 37; Pim's tubular, 38; Grey's feeding apparatus, 39; Hornsby's (agricultural). 39; Prosser's feed apparatus and tube clearing process, 196; Newton's improvements, 196; Smith's feeding apparatus, 219; Grant's improvements, 342; Babington's preventing incrustation, 379; Nasmyth's absolute safety valve, 430, 472; Mr. W. Fairbairn, on the construction of, and the causes of their explosion, 436, 453, 507; Turner's improvements in heating, 496; Johnson's, 490; Auld's, 515
——— engines: Colegrave's patent slide valves, 37; Tuxford's agricultural, 38; Hornsby's, 39; Thomson's priming preventer; 58, 65; Mill's improvements, 78, 82; Pirsson's condenser, 102; Holl's improvements, 159; Bruce's rotary, 179; Barclay's rotary, 216; Cochrane and Francis's, 216; Smith's, 218; Boggett and Smith's rotary, 282, 299; Fernihough's improvements, 318; Fowler's, 337; Harding's, 337; Edwards, Ansell, and Heyns's, 398; Morrell's rotary, 398; Wimshurst's, 413; Nye's, 413; Newton's, 478; Johnson's, 499; Auld's, 515
——— generating, Leroy's patent improvements in, 118; York's, 350
——— navigation in America, 187, 256
——— vessels, Bosphorus, 36; Osprey, 102: American Transatlantic, 187, 324; Atlantic, 187, 324; Pacific, 187, 324; Arctic, 187, 324; Baltic, 187, 324; Asia, 187, 324; Iberia, 215; Prometheus, 257
——— effect of lightning storms on, 213
Steel, Sylvester's patent improvements in straightening, flattening, and setting hardened, 74; Newton's improvements in alloying with zinc, 98; Dick's improvements in the manufacture of 177; Riepe's refining, 476; Ommanney's, 515
——— etching process, Dr. Pring's 253
Steele's patent improvements in electro-coating metals, 134
Steering vessels: Beattie's patent method of 216; Cochrane and Francis's, 216; Robinson's, 397; Captain Carpenter's, 462
Stone, artificial, Massiah's patent, 135
Stone cutting and dressing, Newton's patent improvements in, 514
——— sawing machinery, Randell and Saunders's patent, 21
——— working, Liebhaber's patent improvements in, 415
Stove, Knowles' registered illuminating gas, 170; Slate's patent improvements in, 378; Ritchie's, 458
Straw shakers, Tuxford's patent, 38
Sketching woven fabrics, Mather and Edmeston's patent improvements in, 218
Submarine navigation; Dr. Payerne's system, 211; Fulton's *bateau plongeur*, 211
——— telegraphs, Shepherd and Button's patent improvements in, 438
Sugar, manufacture of, Bessemer's patent improvements in, 136, Shears's, 338; Nind's, 516
———, refining, Bessemer's patent improvements in 136, Shears's, 338
Sulphates of soda and alumina, Gossage's patent improvements in obtaining 76, 517
Sulphuric acid, concentrating, Gossage's patent improvements in, 517
Supporters, abdominal, Brooman's patent improvements in, 117
Surface printing electrotypes, 252
Survivorship assurances, new table of the values of, 48
Suspending carriages, Dunbar's patent method of, 97
Suspension bridges; the Victoria, 35; Niagara, 73
Swedenborg's discovery of the decomposition of water, 169
Swindell's patent improvements in extracting silver, copper, and zinc, and in making chromic salts, 415
Swing gates, American, 233, 287
Sylvester, J. J., Esq., on the rotation of the earth, 328, 353

Taper dipping frame, Hynam's patent, 117
Tatham and Cheetham's patent improvements in preparing, spinning, and weaving machinery, 377
Taylor's patent improvements in dress pins, fastenings, and ornaments, 517
Theorem, geometrical, by T. T. Wilkinson, Esq., 10, 283
Theory of heat, by A. Trevelyan, Esq., 208
Thimbles, Marsden's patent improvements in, 412
Thomson and Mellish's patent improvements in cutting, staining, silvering, and fixing articles of glass, 179
Thompson's patent case and suction water wheels, 42, 57, 62, 126; centrifugal pump regulator, 58, 65; steam engine priming preventor, 58, 65
Thompson's patent digging machine, 137
Throwing silk, Bury's patent improvements in machinery for, 318
Tiffereau's patent hydraulic clocks, 299
Tiles, Beart's patent improvements in the manufacture of, 319; Ainslie's, 458
Tissue bandages, Gage's patent, 459
Tomlinson, C. Esq., on the manufacture of smalt, 306
Tooth, artificial, manufactory at Needham, 310
Toys, rational, 494
Trattles's patent improvements in saw-sets and mallets, 118
Traversing trucks, Dunn's patent, 418
Tredgold's Treatise on the steam engine, and theory of the rotary engine, 409
Tubular cranes, Fairbairn's patent, 382
Turner's patent improvements in heating steam and other boilers, 496
"Turning and Mechanical manipulation, Holtzapffel's, vol. iii.," 50
——— machinery, Weild's patent improvements in, 497
Turnip cutters, Phillips's patent, 37; Bendall's, 438
Turn tables, Dunn's patent, 418
Tuxford's patent clod crushers, straw shakers, and agricultural steam engines, 38
Twisting machinery, Bury's patent, 317; Christie's, 398
Type cutting machine, Newton's patent, 197
——— galvanized, 512

Ultramarine, artificial, 395
Umbrellas, Pittar's patent improvements in, 159; Holland's, 197
Unsealed patents, new order of the Lord Chancellor respecting, 376
Urinals, Rishton's patent improvements in, 119
Utility, designs for articles of, registered, 20, 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, 300, 320, 340, 360, 380, 400, 420, 440, 460, 480, 500

Valves, Colegrave's patent slide, 37; Carnell and Hosking's registered treble beat hydraulic, 142; Hosking's patent, 419; Nasmyth's absolute safety, 430, 472
Vans, Hazeldine's patent improvements in, 99
Vegetables, preserving, Masson's patent improvements in, 414
Velvets, Shiers and Heginbottom's patent improvements in the manufacture of, 459
Ventilating, Pascal's patent improvements in, 137; Hamilton and Weems's, 437
Vidie's patent improvements in pressure indicators, 399
Voyez's patent paper hangings, 478

Wafers, Gage's patent, 459
Wagons, Hazeldine's patent improvements in, 99
Warlock's lead smelting machinery, 394
Warming and ventilating, Hamilton and Weems's patent improvements in, 437
Warmont's patent improvements in dying yarns, 377
Washing machinery, Mather and Kaselowsky's patent, 379; Chabert's, 459
Water: decomposition of, Swedenborg's discovery of, 169; impurities of river, 194; method of obtaining fresh, at sea, 270; a redhot solid column of, 375
——— closets, Beetson's patent improvements in, 97; Bell's, 99; Rishton's, 119; Everest and Osborne's, 478
——— gas, Shepard's patent, 129
Water, law of resistance to the passage of bodies through, 47
——— meters, Parkinson's patent, 214
———proofing, Jenning's patent improvements in, 96
——— purifying processes, Brooman's (Lelong Burnet's) patent, 242
Water-wheels, Mr. Thomson's patent case, 42, 57, 126; suction, 58, 62, 126; Gwynne's double-acting balanced pressure, 134, 322
Watson's patent improvements in the manufacture of hat plush, 459
Watt's patent improvements in canal navigation, 219
Weatherley's currant cleaning machine, 148
Weaving machinery, Hall's stop motion, 54; Fairbairn and Hetherington's patent, 116; Meyers, 137; Cross's, 218; Brisbane's, 250; Eccles's, 258; Newton's, 259; Crossley, Collier, and Hudson's, 277; Browne's, 358; Borland's, 370; Tatham and Cheetham's, 377; Christie's, 398; Haley's, 417; Shiers and Heginbottom's, 459; Platt's, 459
Webster, T. Esq., barrister-at-law, plan of patent law reform, 7
Weild's patent improvements in turning and burnishing machinery, 497
Welch's patent globular windguard, 93
Wheels, Haddan's patent railway, 39, Crosskill's registered nave, 210; method of bending felloes in Russia, 270
White's patent bruising and juice expressing machinery, 119, 122
Wild's patent improvements in floating and graving docks and lock gates, 138
Wilkins's patent improvements in lighting, lighthouses, and signal lights, 397
Wilkinson, T. T., Esq., F.R.A.S., geometrical theorems, 10, 283; porisms, 157; contributions to the history of mathematical periodicals, 447, 474, 492
Williams's patent improvements in the manufacture of buttons, 338
——— (D. L.), patent furnaces, 477
Wilson's sewing machine, 222
Winches, Baxter's patent improvements in, 513
Windguard, Welch's patent globular, 93
Windlasses, working, Robinson's patent improvements in, 395; Baxter's, 513
Windscrews, for Indian river navigation, 190, 297
Windowblinds, Burt's patent, 457; Bunnett's, 513
——— shutters, Bunnett's patent improvements in, 513
Wirework, Newton's patent improvements in, 499
Wood, seasoning, on a small scale, method of, 165
Wood's patent improvements in the manufacture of carpets, 317
——— (H. W.), patent improvements in the manufacture of fuel, 476
——— (P.), patent improvements in figuring and ornamenting woven fabrics, 497
Woodbridge's patent machinery for manufacturing rivets, bolts, and screws-blanks, 218
Woods's patent improvement in paving, 456
Wool, Metcalf's improvements in removing electricity from, 55; Illingworth's preparing machinery, 197; Ritchie's preparing and carding, 258
Woollen cloth, Edmonds's patent improvements in the manufacture of, 95; Nickel's, 458
Woolley, Dr., new method of finding the displacement in naval architecture, 262; Mr. Russell's wave line theory, 268; the received methods of calculating the displacement, 347, 423, 451; Fincham's "History of Naval Architecture," 347, 423, 451

Yarns, Chevalier Claussen's patent improvements in, 142; Newton's dyeing, 259; Crossley, Collier and Hudson's printing, 277; Newton's manufacturing, 317; Warmont's dyeing, 377; Kurtz's, 419; D'Orville and Partington's finishing, 515
York's patent improvements in generating steam, 359
Young, Professor J. R., on the rotation of the earth, 352, 372, 392; Oerstedt's experiments on falling bodies, 393
Young's patent improvements in obtaining parafine, 334
Young's registered rotary boot and shoe cleaner, 171

Zinc, Newton's improvements in the manufacture and application of, 98; Swindell's, 415
Zinc, oxide of, Scott's patent improvements in the manufacture of, 98; Newton's, 98

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MESSRS. ROSENBORG AND MONTGOMERY'S PATENT CASK-MAKING MACHINERY.

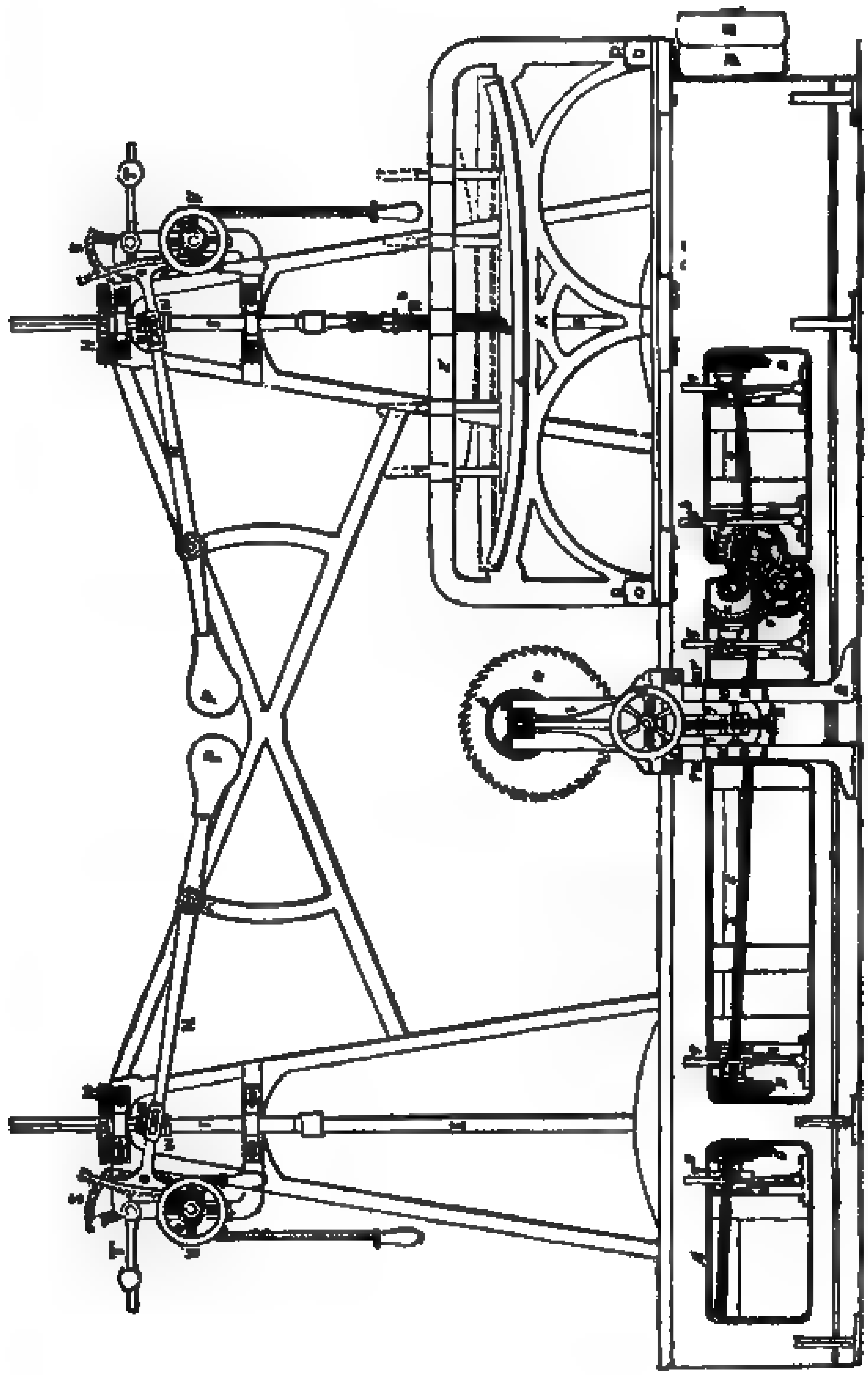


Fig. 1.

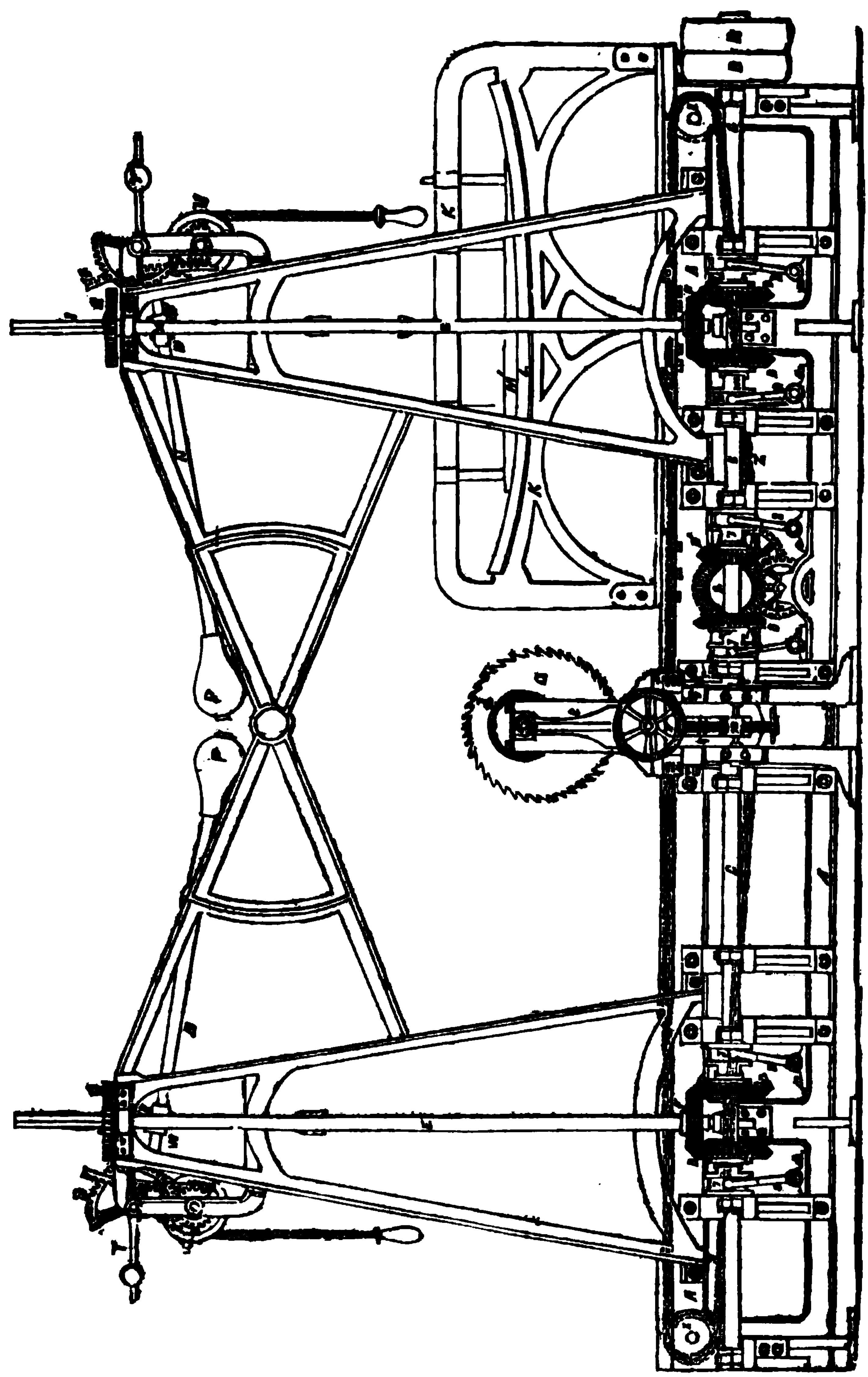
MESSRS. ROSENBORG AND MONTGOMERY'S PATENT CASK-MAKING MACHINERY.

We commence this new volume of our work with the description of a piece of machinery as remarkable for its ingenuity as any that has for a long time come under our notice. The Patent of Messrs. Rosenborg and Montgomery comprehends a number of processes or mechanical arrangements relating to cask-making, all of which are more or less new and valuable. First, there is a method of sawing wood into pieces or blanks suitable for staves; second, a method of converting these blanks into staves; third, one for combining the staves into casks; and fourth, an apparatus for drilling the holes or sockets in the heads of casks for the reception of the dowels necessary for keeping the parts together. It is the machine comprehended under the second of these heads which has particularly struck us for its ingenuity, and which we here propose to describe. A simple statement of the problem of which it is the practical solution, will suffice to convey to the reader a clear idea of the difficulties which the inventors had to overcome. The problem was this:—To take any given number of flat rectangular staves, and so shape the whole at one operation that when built up together into a cask, they shall every one have the exact bevel, bulge, and taper which is requisite for the formation of the cask. The new machinery by which Messrs. Rosenborg and Montgomery have accomplished this rare combination of difficult achievements is represented in the accompanying engravings, of which the following is their own description:—

Fig. 1 represents a front elevation, fig. 2 a back elevation, fig. 3 an end view, and fig. 4 a cross section of this machine. A is the framework; B B the loose and fast-driving pulleys on the main shaft C; D D bevel wheels which run loose on the shaft; E E vertical shafts which revolve at right angles to the main shaft C, and are put in motion by bevel wheels F F. G and H are spur wheels which communicate motion to the vertical shafts I I at the front of the machine; K is a frame which slides on the framework A, and carries the blank which is to be formed into a stave. M^1 is a pressing block, which is made of a convex form on its under surface, corresponding exactly with the interior curve of the intended stave. M^2 is a screw which is passed through the top bar of the frame K, and acts upon the block M^1; N is a lever centred at *n*, which has a toothed segment O on one end, and a counter weight P on the other. Q is a pinion which works into the toothed segment O; R (see fig. 10, the end view of the machine) is another pinion on the same shaft as Q, which works into another toothed segment S, and thereby gives motion to the tumbler T. U is a cord wheel, by means of which motion is given to the toothed segment O and lever N, and also to the tumbler T. V is a loose socket on the vertical shaft I, which socket is kept in its place by means of two collars W W, and has two pins projecting from it at right angles, which work through slots in the eye-piece X of the lever N, which eye piece fits on to the shaft I. Y is a drum which carries the chain Z over the rollers 1, and being fastened to the sliding frame K, gives motion to the same. The chain drum Y receives its motion through the bevel wheel 2, which works into the bevel wheels D^1 D^1 on the main shaft C; on the other end of the shaft which carries the bevel wheel 2 is a pinion 3, which works into the spur wheel 4, to which spur wheel is attached the pinion 5, which works into the spur wheel 6 on the shaft of the chain drum Y. 7 7 are clutch boxes which slide on keys on the main shaft C, and are worked by forked levers 8 8, which again are actuated by the handles 9 9, as seen in the front view of the machine, fig. 8. *a a* are circular saws which are fixed to the shafts *b b*, to which shafts motion is given by the strap pulleys; *c d* are loose strap pulleys on the same shafts *b b*. The shafts *b b* are mounted in frames *e e*, which are made to slide on the plates *f* by means of V champs; *g g* are screws by which sliding motion is given to the frames *e*, the screws working in the nuts *h* affixed to the frames *e e*. The spindles of the screws *g g* are mounted on the plates *f f*, and carry at their outer ends hand wheels *i i*; *k k* are swivel joints fastened underneath the plates *f f*; *l l* are screws, the upper and plain ends of which work into the swivels *k k*, and are so kept in their places by means of pins which fit into circular grooves cut in the ends thereof. The screws *l l* are also tapped through a swivel nut *m*, which has its bearings in plummer blocks attached to the frame A, and have hand wheels *n n* at their lower ends. The plates *f f* have lugs *o o* fastened on their inner ends, which lugs work upon shafts *p p*, and so form centres for the circular motion of the plates *f f*. The plates *f f* are provided also underneath with guides *q q*, which work tight in the framework A. The guides *q q* have two screws *r r* tapped into them on each side, which work through slots *s s* in the framework A. The machine is

worked in the following manner:—The sliding-frame K being placed at one end of the machine, so that the screw M^2 is in the same vertical line with the shaft I, the pressing block M^1 being raised close under the top of the frame K (see dotted lines in fig. 8), the blank required to be shaped into a stave is placed in the frame K. The handle 9^a is moved towards the left, so as to couple the clutch-box 7 with one of the bevil wheels D. Motion being communicated to the vertical shaft I, in the front of the machine the man takes hold of the cord-handle nearest to the shaft I, and turns the cord-wheel U. By doing so, the

Fig. 2.



vertical shaft I will be lowered down upon the square part of the screw M^2 (the socket of the vertical shaft I fitting over the square top of the screw), and the tumbler T being partly

moved over to the other side, will keep the shaft I close upon the screw M^2. The screw will now turn round, and thereby bring the pressing block M^1 down upon the blank piece of wood, and by the motion being continued will press it down in a curved position close against the bed of the frame K. The wood will now have the shape given to it which it is required to possess when put into its place as a stave in the formation of a cask. When the blank has thus been bent, the same handle 9^a is moved towards the right, whereby the clutch-box 7 is disengaged from the bevil-wheel D. The motion of the screw is thus stopped, and the workman, by taking hold of the corded handle farthest from the shaft I, causes the cord wheel U to turn round, by means of which the shaft I is disengaged from the screw M^2, and raised to its former position. The workman now takes hold of the

Fig. 4.

Fig. 3.

handle 9^b, which couples the chain motion, and by moving that handle so as to bring the corresponding clutch-box into gear, the chain drum Y will turn round, by means of which the slide K will be put in motion. The circular saws *a a*, being always in motion when this machine is at work, the blank will now be brought into contact with them, and both the sides of the blank will thereby be cut as the slide continues to move betwixt the saws *a a*. When the slide K arrives at the other end of the machine, the handle 9^b, for the chain-coupling is moved by the workman, so as to detach the clutch-box from the bevil-wheel D, and thereby stop the motion of the slide, which will now be in the same position at this end of the machine as it was before at the other end, that is to say, the screw M^2 will be in the same line with the vertical shaft I at this end of the machine. One of the handles 9^a is now moved by the workman putting the shaft I at this end of the machine in motion in the reverse direction, which being done, the workman takes hold of the corded handle nearest to the shaft I, and by twining round the cord-wheel U, causes the shaft I to descend upon the screw M^2, and thereby puts that screw in motion, which causes the pressing block M^1 to rise up under the top of the frame K. The workman now stops the motion of the shaft I, but he does not disengage that shaft from the screw M^2. The staves

being now completed, is removed from the frame K, a fresh blank put in, and the preceding operation repeated, but in the reverse direction of the machine. In order to enable the workman to vary the width of the cut staves, and also to enable him to alter the position of the saws to cut the various bevils required for different-sized casks, the saws are adjusted in the following manner:—Having determined upon the required width of the stave, he moves the hand-wheels *i i*, and by means of the screw *g g*, adjust the frames *e e*, and the saws *a a*, to the requisite distance from the central line of the framework K. Having done this, he moves round the hand-wheels *s s*, on the screws *l l*, and thereby causes the outer ends of the plates *f f* to rise or fall, in order to place the saws *a a* in a position to form the radii, or nearly so, of the circle of the cask to be made (see the dotted lines *t t*, fig. 11). He now tightens the bolts *r r* on both sides of the guides *q q*, outside the frame A, whereby the angular position of the plates *f f* is secured. With such modifications as will readily suggest themselves to a competent workman, the blank in its longitudinally curved state may be submitted to a circular-saw bench, to a planing or other cutting machine, or to suitable cutting tools, in order to produce a stave with the bevil bulge and taper requisite for its formation into a cask; a stave may thus be formed either by machine or hand-power, and one or both sides may be completed in one operation.

The improved machinery of Messrs. Rosenborg and Montgomery has not been as yet, many months in operation, but already a very considerable number of casks of nearly all descriptions have been manufactured by them; viz., oil butts for the fisheries, water-butts for emigrants, rum puncheons, sherry pipes hogsheads and quarter-casks, beer hogsheads, and barrels for exportation and inland trade, spirit puncheons, &c., &c. Of these, some have been sent to the Hudson Bay Company's settlements, some to Spain, to the West Indies, to the coast of Africa, to the East Indies, to Australia, and to New Zealand.

All these casks have given the utmost satisfaction with the exception of a very few of those first put together, before the machinery was in perfect working order. Certainly casks cannot be made by hand to equal such as we saw turned out the other day. The mathematical correctness with which the staves are shaped (or "jointed," as the coopers call it,) by these machines, gives much greater strength and tightness to the casks than we ever witnessed before. The hand-coopers *art* in giving form to the stave, is a very difficult one, and requires long practice. He works entirely by measure of the eye; but however well instructed he may have been—however expert he may have become in hitting angles—still he cuts away to a certain extent at random, and it is therefore impossible that he can attain to that accuracy which is necessary to make a stave *a perfect part of a cask*. Besides casks of different shapes and sizes require staves of different forms, depending upon the greater or lesser "bilge" and length, by which the curvature of the lines of the staves must be determined. Another most difficult and important matter to be attended to is *the bevelling of the edges*. As the cask varies in diameter from the middle or highest point of the bilge to the end or "head," so must the bevel of the edges of each stave vary accordingly, in order to produce a good or "tight joint," or to make the stave fit well in its place. It is no doubt this latter circumstance which has presented to inventors hitherto, the principal difficulty in the way of constructing machines for jointing staves. By the machinery of Messrs. Rosenborg and Montgomery, the curvature of the lines, as well as the varied bevel of the edges, are given to the staves with unerring correctness, whatever may be the shapes and sizes of the casks.

We are not in possession of sufficient data to form an accurate estimate of the economy attending the use of this machinery; but one fact bearing on this point we may mention. A principal jointing machine of an average size, or adjusted for making hogsheads, with the attendance of two boys, can joint sufficient staves for ninety hogsheads in one day of ten hours; which is, we understand, more than what can be done *regularly* by twenty-five experienced coopers.

The public has now before it three different plans of Patent Law Reform. I. One proposed by a Committee of the Society of Arts. II. Another, of which Mr. Webster, the barrister, so well-known for his works on the Law and Practice of Patents, is the author; and III. The plan of the Association of Patentees for the Protection and Regulation of Patent Property. We shall now lay the principal features of these plans before our readers, accompanied with a few remarks of our own on each.

I. *The Plan of the Committee of the Society of Arts* (Dec., 1850):

The following have been reported to the Society as "Resolutions" passed (by the Committee) to form the "Heads of a Bill."

1. That everything in respect of which a patent may now be granted should be registered.

2. That the benefits afforded by registration should extend to the United Kingdom of Great Britain and Ireland, and the Channel Islands.

3. That the registration should be considered merely as a record of claims, and not as any determination of rights between parties.

4. That it should be competent to an inventor to make disclaimers and to rectify errors in his specification at any period.

5. That registration of inventions should be obtainable for a period of one year on payment of 5*l*., and should be renewable for four periods of five years' each, on payment of 10*l*. at first renewal; of 20*l*. at second renewal; of 50*l*. at third renewal; and of 100*l*. at fourth renewal. [The principle of renewed payments is proposed as a means of testing whether an invention is in use, and of removing useless inventive rights that might otherwise be obstructive of improvements.]

6. That there should be penalties for using the title of "patent" or "registration" where none has ever existed.

7. That the present tribunals are insufficient for the trial of subjects of design and invention.

8. That it should be permitted to commence actions for infringement of the rights of inventors in the County Courts.

9. That inasmuch as, contrary to expectation, very little litigation has been created by the rights conferred by the Designs Act of 1842 and 1843, this Committee is of opinion that a fair trial should be given to the working of the proposed system of registration of inventions before any special tribunal to determine inventive rights is substituted for the existing tribunals.

10. That any tribunal before which proceedings are commenced should have power to refer any case for report and certificate to the Registrar, assisted by competent and scientific persons.

11. That upon the illegality of the registration being established by the judgment or order of any competent tribunal, the registration be cancelled.

12. That there should be only one office for the transaction of business connected with the registration of inventions, and the payment of fees in respect thereof.

13. That every person desiring to register an invention should submit two copies of the specification of his claim, accompanied, in every case where it is possible by descriptive drawings.

14. That the mode of procedure of registration should be regulated by the Board of Trade, subject to a report to Parliament.

15. That an annual report of all specifications registered, with proper indices and calendars, should be laid before Parliament.

16. That a collection of all the specifications should be made, calendared, and indexed, and deposited for public information in the British Museum.

17. That it is highly desirable that such a collection should be printed and published.

18. That the surplus profits, after paying office expenses and compensation, should be directly applied to some public purpose connected with invention, but not carried to the Consolidated Fund.

The general scope of this plan, it will be perceived, is to substitute a *system of registration of claims*, for the existing one *of grants from the Crown*—to do away, in short, with Letters Patent altogether. Many objections occur to such a system of registration, but it may suffice to state two or three of the more obvious:—

First. It is without precedent or example in the jurisprudence of this or any other country in the civilized world.

Second. It rests on no evidence whatever of probable utility. And

Third. It is encumbered with useless forms, and would make Patent rights more expensive than they now are or need to be.

Minor exceptions it is hardly worth

taking; yet there are several points in the "Resolutions" by the Committee, so provocative of remark, that we cannot pass them wholly over in silence.

Resolution 2 proposes to confine the "benefits afforded by registration to the United Kingdom of Great Britain and Ireland and the Channel Islands." The Colonies and Foreign Possessions of the Crown are to be excluded. Why?

Res. 4 proposes to give patentees (registrees) a privilege which they already possess.

Res. 7, that "the present tribunals are *insufficient* for the trial of subjects of design and invention," is one which could not have been adopted by any body of persons containing a single competent judge of the matter. The general soundness of the decisions of the English Judges on points of Patent-law, is not only universally acknowledged by our own lawyers, but has had the cordial assent of the most enlightened jurists of other countries. *Expensive and dilatory* our legal proceedings may be; but that is another affair.

Res. 9 proceeds on the assumption that "very little litigation has been created by the Designs Act of 1842 and 1843." How have the Committee ascertained this? Have they taken any pains to ascertain it? We believe the very reverse to be the case, and that there have been more Registration than Patent cases since the Designs Acts came into operation. We speak from actual experience—but the Committee from none; for there is not a man amongst them practically acquainted with the subject.

Res. 10 speaks of a "*Registrar*." This is the first we have heard of this gentleman; like the snake in the grass, he is slow in unfolding himself. Pray, which of all this intelligent Committee is intended for this new and (no doubt) intended-to-be-handsomely-paid office?—What are to be his qualifications? Or is it deemed superfluous (impertinent perhaps) to make any such inquiry.

Res. 14 proposes that there shall be "a mode and procedure of Registration regulated by the Board of Trade." So there is to be "a mode and procedure," just as there is "a mode and procedure" now, and which, for anything the Committee know or can tell, may be just as bad.

Res. 16 proposes "that a collection of all the specifications should be made, calendared, and indexed, and deposited for fuller information in the British Museum;" and Res. 17 declares it to be "highly desirable that such a collection should be printed and published." Such a proposition as this can proceed from only one of two sources—either downright ignorance, or a spirit of the grossest jobbing. A collection of the kind here recommended would take twenty years at least to make; it must necessarily cost an enormous sum of money; and when made, nine-tenths of it would be sheer rubbish. Besides, all that need be done in this way has been already done, or is in the course of being done, by the Record Commissioners, of whose labours the reader will find abundant and satisfactory specimens in the past volumes of this Journal.

II.—*Mr. Webster's Plan* (30th Nov., 1850):—

First.—As to the proceedings for obtaining letters Patent.

I. Application to be made by petition and declaration, accompanied with a deposit or outline of heads of invention signed by the applicant.

II. The petition, declaration, and deposit (a minute of the application having been entered in the books at the Home Office) to be referred to the Attorney or Solicitor General for England, at the option of the applicant; and to be taken, sealed up, from the Home Office to the Patent Office, for the purpose of such reference.

III. The law officer to whom the application is referred having examined the deposit, and being satisfied of its sufficiency in point of form, the application is to be advertised in the London, Edinburgh, and Dublin *Gazettes*; the advertisement to contain the name of the applicant, the date of the application, the title of the invention, and to require any person wishing to oppose to enter a caveat, accompanied with full particulars of the grounds upon which the application is to be opposed, by a certain day at the Patent Office.

[The notice of objections to be examined and compared with the deposit of the op-

posed Patent by the law officer to whom the reference is made; who will, if necessary, call the parties before him, or require further information, or allow the Patent to proceed as of course, if there be no interference or other objection.]

IV. The report of the law officer to be taken to the Patent Office for the preparation of the Queen's warrant.

V. The Queen's warrant, signed by the Secretary of State, to be sent to the office of the Keeper of the Seal in the respective countries; and when signed by the law officer of that country, to be the warrant for the sealing of the Letters Patent, in the same manner as the Privy Seal, the Queen's Letter, and the Sign Manual Warrant respectively are at present the authority or warrant for sealing the Letters Patent for England, Ireland, and Scotland respectively.

VI. On the receipt of the warrant at the office of the Keeper of the Seal, advertisements to be again inserted in the London, Edinburgh, and Dublin *Gazettes*, stating the issuing and receipt of such warrant, and requiring parties wishing to oppose the sealing of the Letters Patent to enter a caveat, with notice of objections, at the Seal Office of the respective countries.

VII. The Letters Patent to issue under the same seals as at present, but to be in English, and in the same form for all three countries,—the country only being altered. The Letters Patent to be sealed and bear date as of the day of the application at the Home Office, with power, however, for the Keeper of the Great Seal to seal them of a later date, under special circumstances.

VIII. The Colonies, plantations, and possessions abroad, not to be included in the Letters Patent for England; but Letters Patent for those portions of the United Kingdom to be sealed on a special warrant.

[Hitherto the Colonies have been included in the English Patent; but many questions have recently arisen in respect of them, and it is important they should be kept separate. The Letters Patent for the Colonies, or the East Indies, may be sealed after the six months, and not to be vitiated by prior use in other parts of the United Kingdom, and *vice versâ*.]

IX. Letters Patent might issue to different persons for different parts of the United Kingdom.

Secondly. As to proceedings after grant of Letters Patent.

X. Specifications to be enrolled in London, Edinburgh, and Dublin,—the original specification executed by the Patentees being retained, and filed as the enrolment in all cases.

XI. Indices of the names, subjects, and contents of Letters Patent and Specifications to be prepared.

XII. Assignments and transfers of an interest or share in Letters Patent to be registered at the Patent Office.

XIII. Caveats against the allowance of a disclaimer, and the issue of a *scire facias*, to be entered at the Patent Office.

XIV. The allowance of any disclaimer and memorandum of alteration to be registered at the Patent Office within 24 hours for an English, and 48 hours for a Scotch or Irish Patent, and such allowance to be advertised in the *Gazette* by an officer of the Patent Office.

Thirdly.—As to the Cost of Letters Patents.

XV. The cost of Letters Patent for the United Kingdom, in unopposed cases, not to exceed 130*l*., and to be divided as follows:—England 70*l*.; addition for Scotland, 30*l*.; Ireland, 20*l*.; Colonies, 10*l*.;—total 130*l*.

The charges up to and inclusive of the warrant to be charged for the United Kingdom; that is, they are to be paid through Letters Patent for only one country be sealed; this constant amount may be taken at—say 30*l*.; so that a Patent for Scotland alone would cost, say—60*l*.; for Ireland alone, say—50*l*.; and for the Colonies alone, say—40*l*.

No extra fees for several names. No expedition fees.

The payments to be as follows:—

General Charges for United Kingdom.

1. On application at Home Office....	£10
2. On reference at Patent Office	10
3. For the Warrant at Home Office ..	10
	30

Special for England.

4. At Great Seal Office	£10	
Stamp	30—40	
Total		70

Special for Colonies.

At Seal	£5
Stamp............	5—10

Special for Scotland.

At Seal..........	£10
Stamp	20—30

Special for Ireland.

At Seal..........	£10
Stamp	10—20
Total	£130

According to this scheme, provisional protection for the United Kingdom may be obtained for 20*l*. The total cost for the United Kingdom, in unopposed cases, would

or 130*l*., capable of further reduction at once, by reducing the stamps.

XVI The extra fees, in case of opposition, not to exceed 5*l*. for each hearing before the law officer.

XVII. As to the term of the grant.—Letters Patent are usually granted for 14 years; but it may be expedient to grant Letters Patent for 5 years, at say 60*l*. for the United Kingdom, or say 30*l*. for England and 15*l*. additional for Scotland.

XVIII. Patent Fee Fund.—The fees not specifically appropriated to form a fund to be called the Patent Fee Fund, and to be appropriated in paying salaries, advertisements, general expenses, and compensation for offices abolished.

XIX. Repurchase and cancellation of Letters Patent for Inventions not brought into use.

The annoyance, litigation, and obstruction to the progress of invention from subsisting Patents for inventions altogether or commercially useless, is almost incredible; such Patents are void in law; but until repealed they are used and useful only for extracting money from those who may have remedied the defects, and succeeded in attaining objects or results not previously attained.

If a scale of prices for the repurchase of Patents were established, many patents would be surrendered, and the public would be gainers by a return to the common stock of inventions, which otherwise could not be safely improved upon until the expiration of the Patent.

XX. Concluding Observations. — The above outline scheme may be easily modified in its minor details; but it is believed that it will obviate the numerous defects and grievances admitted and acknowledged to be indefensible in the present practice, without destroying the main features or principles of a system which has been imitated, in a greater or lesser degree, by almost every civilised nation, which has been the subject of numerous solemn judicial decisions, and which has been the foundation of every existing system.

The practice of other countries differs in three material respects: 1. In the commission system; 2. In the annual or periodical payments; 3. In an extremely low rate of charges. I believe that almost every person who has had experience of the working of these systems, or who has examined their necessary operations fully, fairly, and candidly, has come to the conclusion that such features are either inadmissible or inexpedient in this country.

The commission system, as at present administered, does not give satisfaction; commissioners are of necessity as much in *arrear* as inventors are in *advance* of the age; no person ought to be stopped in the career of invention; but it is not for the interest of inventors or of the public that all checks should be removed, or that such legal rights should be too easily attainable. The analogy as to cheap law fails altogether; cheapen the cost of litigation, but do not create litigation by cheapening and multiplying the sources and causes of action beyond what may be necessary for the progress of invention.

The great faults of this plan are, its want of simplicity, and want of completeness as a remedy for the evils of the existing system. It would substitute for a course of procedure, already abundantly complicated, one still more complicated;—it would keep up old distinctions, for which there is no good reason (the three Patents especially for the three ancient divisions of the now United Kingdom), and would establish new distinctions (viii., ix., xvii.), for which there seems to be just as little;—it would make the specifications of Patents only in a very slight degree more accessible than they now are, which is not by nine-tenths what it ought to be;—and it would leave two or three very serious evils wholly untouched: *e. g.*, the inequality in the range of Patents—some being confined to a single invention only—while others embrace inventions by the dozen and score—the practice of granting Patents for inventions imported from abroad, to any one who may choose to apply for them, whether authorized by the inventor or not, and sometimes, as in a well-known case (the Daguerreotype), even in spite of him; and the dilatoriness of all legal proceedings in regard to infringements, even in the simplest cases. The proposition (xix.) with which Mr. Webster concludes—that provision should be made for buying up, on public account, all such Patents as are in the hands of the patentees themselves good for nothing (!)—is of a more droll kind than we should have expected from so grave a quarter. Need we say that it would amount simply to the offering of a Government bounty on mechanical trash?

III. *The Plan of the Association of*

Patentees and Proprietors of Patents for the Protection and Regulation of Patent Property.

[From No. 1 of printed papers of the Association, 1st Jan., 1851.]

Object First.—The Simplification and Consolidation of the Present Proceedings for Obtaining Patents.

1. It is proposed, under this head, to ABROGATE THE WHOLE OF THESE PROCEEDINGS—admitted on all hands to be unnecessarily complex and multifarious—and to substitute in lieu thereof, one single official act of the nature of an entry or record of the Patent-right, precisely similar to the entry of a literary copyright at Stationers' Hall.

2. The practice of requiring separate Patents to be taken out for England, Scotland, Ireland, and (in certain cases) for the Colonies, to be abolished, and ONE PATENT TO SUFFICE FOR THE WHOLE OF THE UNITED KINGDOM, OR BRITISH EMPIRE. The various Colonies and foreign possessions of the British Crown to be included; and also (if practicable) the East Indies, which are not now covered by any Patent.

3. The Patent (for the whole empire) to be granted on the inventor filing at the Inrolment Office a specification under his hand and seal of his invention, with a declaration annexed, that the invention is (to the best of his knowledge and belief) new and useful, and that he is the first and true inventor.

4. Consequent on this change, would be the abolition of the practice of allowing six months after the date of the Patent, to specify—a practice which exists in no other country but England, and is a notorious source of fraud and inconvenience.

5. Every person applying for a Patent, and lodging the specification and declaration required, to be at once entitled to the Patent, but always at his own risk; that is to say, subject to its after impeachment, in due course of law, on any of the three grounds—1. Want of novelty; 2. Want of utility; and 3. Want of title. This is the practice now followed in France, and it is found to work well; also in Holland, Austria, and Spain.

Object Second.—The Reduction of the Expenses within Safe and Moderate Limits.

6. An unrestricted multiplication of monopolies in the arts and manufactures (such as would result from granting them for the asking, *if the expense were trifling*) is regarded as contrary to the general freedom of trade and commerce, guaranteed by the common and statute law of England, and as likely to prove a great hindrance and obstruction to industrial enterprize.

7. Neither is it considered to be at all necessary for the due encouragement of inventive genius, that the multiplication of such monopolies should be unrestricted.

8. The law-officers of the Crown have now a discretionary power to grant or refuse Patents (or, which amounts to the same thing, to report in favour of or against them); but they exercise the power only in opposed cases, and hence its operation is partial and unequal.

9. Boards of scientific examiners have been proposed to be substituted, but they are open to many and (apparently) insurmountable objections. They have been tried in other countries (Prussia, Belgium, and the United States), and have nowhere given satisfaction.

10. The best check to a pernicious multiplication of Patents, which the circumstances of the case seem to admit of, is, to subject them to a money tax, of such moderate amount as may induce due caution without being prohibitory or oppressive.

11. The present cost of the three patents for England, Scotland, and Ireland is 320*l.* Should the Colonies form the subject of a separate Patent (instead of being included, as they may be, in the one for England), the total expense is raised to 430*l.* (exclusive of the specifications, one under each Patent).

12. It is proposed that the *one Patent for the whole empire* should cost, in lieu of all other charges, 100*l.*

13. A Patent for fourteen years for the whole empire would, it is believed, be universally considered as cheaply obtained at this sum; especially when combined with the more certain protection to Patent rights contemplated under Objects Third and Fourth.

14. An author of a useful invention would then be in no worse case than the author of a book, who has the expense of paper, printing, binding, &c., to meet before he can give it to the world,—an expense which often greatly exceeds 100*l.*, and is rarely much less.

15. Every Patent to contain only one substantive matter, as is the case in France, Spain, and the United States. Equal justice to inventors and the public requires that this rule should be observed; for, according to the existing practice, while one Patent may be confined to a single invention, another may be so worded to comprehend a great many. Inventors are thus taxed most unequally, some paying ten and twenty times as much as others. The revenue, too, is by this means defrauded; the number of Patents taken out being thereby diminished by at least one-third.

16. The Lords of the Privy Council to retain the power they possess under the 7 and 8 Vict., c. 69, of renewing Letters

Patent for any term not exceeding fourteen years; but no fee to be payable on renewal (other than the fees attending the application).

17. According to calculations which have been made, and are in course of careful verification, the revenue from Patents under this new system would be so much in excess of what they now produce, as to furnish an ample surplus fund for the indemnification of all parties, who may have vested interests in the fees arising from the forms proposed to be abolished under Object First.

Object Third.—An Improved System of Inrolment.

18. The specification not to be in *writing* as heretofore, but PRINTED, and the explanatory drawings (if any) ENGRAVED.

19. The specifications to be on paper and in type of uniform size, with marginal indices.

20. Every specification to contain a distinct statement of what is claimed as new and useful. The omission of such statement to render the Patent null and void.

21. The patentee to lodge along with the signed and sealed specification 475 copies of it, which are to be distributed as follows:

To Public Libraries	20
To Parliamentary Boroughs	385
To the Capitals of British Colonies	55
To Foreign Governments (for the reason of this, see remarks under Object Fifth)	15
	475

22. Publicity would thus be given to every new invention and improvement to an extent and with a rapidity never before realized or imagined.

23. And this without *one shilling of additional cost to the patentee.* For it is capable of proof that the entire expense to which a patentee would thus be put for engraving and printing (including a reasonable fee—say one or two guineas—to be paid to the Keeper of the Inrolment Office for the trouble of himself and clerks), would not, on the average, exceed more than what he pays for specifying under the present most defective and unsatisfactory system.

Object Fourth.—The readier Verification of Patented Productions, and more Summary Redress for Infringements.

24. All articles manufactured under Patent to have conspicuously marked thereon (where practicable) the word "Patent," the date of the Patent, and the name and residence of the patentee. Penalty for default—the forfeiture of the Patent.

25. Actions for Infringement to be brought in the County Courts in England, Sheriffs' Courts in Scotland, and Civil Bill Courts in Ireland, and to be decided there if the defence shall consist only in a denial of the fact of infringement, and not go to the validity of the Patent on any of the three grounds of want of novelty, want of utility, or want of title (in the patentee).

Object Fifth. — International Arrangements for a Mutual Recognition of the Rights of Inventors.

26. Any person patenting an invention in one country, that person or assignees to have the sole and exclusive title to a Patent for the same in every other country for the space of six months after the date of his original Patent.

27. Patents of importation in the name of parties other than the inventor or his assignees to be abolished in every country.

The superiority of this plan to both of the preceding must instantly strike every reader. It is one worthy of all acceptance, and of universal support. Large, comprehensive, complete, and at the same time simple, beyond anything ever before proposed in relation to the law of Patents. It has only to be carried out in its general features to secure, in our opinion, alike to inventors and the public, the greatest possible benefit derivable from inventions, with the least possible trouble, and at the lowest (safety) price.

Of *forms* it would sweep away all but what are absolutely essential, and for the obvious reason that every needless form is a needless grievance. The inventor would have his Patent the moment he was ready for it. All preliminary and provisional proceedings done away with, and along with them every opportunity for fraudulent interception. One application, one specification, one payment, one grant *for the whole empire.* The singleness and directness of this mode of procedure are altogether admirable.

The *Price* the Association do not propose to make in any case so cheap, nor in any case so dear, as proposed by both of the other plans — conceiving that to make Patents too cheap is just as impolitic as to make them too dear. We quite agree with them in this; and fully partake of the confidence they express that "a Patent for fourteen years for *the whole empire* will be universally considered as cheaply obtained" for the sum proposed (100*l.*)

The *Specifications* would be made by the plan of the Association instantly accessable *everywhere* as soon as enrolled—not in the metropolis merely, nor merely in the capitals of the three countries (as Mr. Webster proposes), but in every town of the United Kingdom—in every great public library—in every considerable place in the Colonies and in every foreign capital—an advantage to the public of immeasurable importance, and yet to be obtained without imposing one shilling of additional cost on the inventor! A piece of reform this, which is of itself worth all the others put together, and which, it is worth remarking, is not dependent upon any of them for its success; for specifications might be printed, and the explanatory drawings engraved, even though all the other points of practice were to be left as they are.

The proposed changes in *the law procedure regarding infringements* are but faintly developed in the published plan of the Association; but enough is disclosed to satisfy us that they are conceived in an intelligent and practical spirit. Like the Society of Arts Committee, the Association would have actions of infringement brought in the Couny Courts tof England, but finally determined there, in the event only of the fact of infringement being the sole point in dispute, and not either the novelty or utility of the invention, or the claim of the patentee to be considered as the inventor. The simple fact of infringement is one which the County Courts are capable enough of trying; but the other points are such as the higher courts alone are competent to deal with. The Association,' too, would give the same powers to the Sheriffs' Courts in Scotland, and Civil Bill Courts in Ireland, as to the County Courts in England.

Patents of Importation (except in the names of the real inventors or their assignees) the Association propose to abolish entirely; and we think most wisely. In the present circumstances of society—with a constant communication going on between all parts of the world, and a press more or less free everywhere, the policy which formerly dictated the sanction of this class of Patents has ceased to have any rational basis. Inventors by right of abstraction from others, are like sea-shore wreckers; they can have no rights.

But the right of the inventor and his assigness to *foreign Patents*, the Association would extend and secure to a degree never before proposed, or perhaps thought of; "Any person patenting an invention in one country, or his assignee, is to have the sole and exclusive title to a Patent in every other country for the space of six months after the date of his assigned Patent." The change here proposed is so obviously reasonable, and so much for the advantage of inventors in all countries, that we make no doubt of its being everywhere most cordially welcomed and responded to.

ON AN IMPORTANT GEOMETRICAL THEOREM. BY THOMAS WILKINSON, ESQ., F.R.A.S.

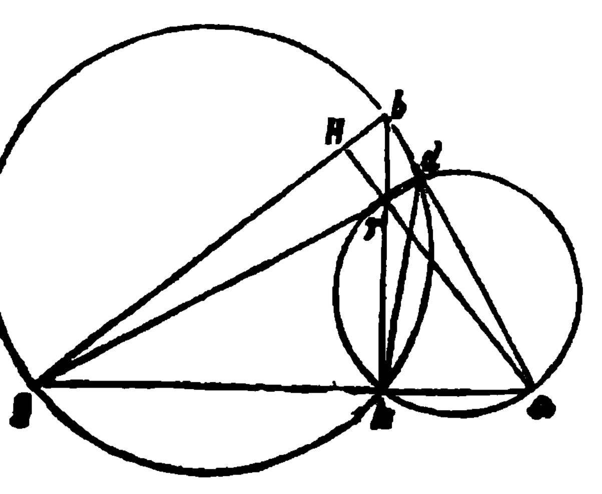
In my article on Holliday's "*Miscellanea Curiosa Mathematica*," inserted in No. 1411, *Mech. Mag.*, page 145, I have noticed "a *new* Proposition in Geometry," demonstrated by Mr. William Chapple, an extensive contributor to the mathematical periodicals of his time. This proposition is the now well-known property that "the three perpendiculars of any triangle intersect in the same point," which Mr. Chapple was induced to submit to the Editor for insertion in consequence of its having "been *often* taken for granted, but nowhere demonstrated, that [he had] seen." The *assumed* property had indeed been "taken for granted," both in the *Gentleman's* and *Lady's Diaries* for 1743 and 1745 respectively, and on not finding it elsewhere, I concluded that "the honour of a *formal* enunciation and demonstration was due to Mr. Chapple," and this opinion was adopted without modification by Professor Davies in his "Geometry and Geometers," No. VI. *Phil. Mag.*, September, 1850. Subsequent considerations convinced me how extremely improbable it was, that the property should have become so familiar to mathematicians previously to its ever having been formally stated; and under

this impression, I examined all the works of the earlier geometers within my reach, expecting at least to find some hint from which the fact might readily be inferred; but without success. A few days ago, however, a chance circumstance led me to refer to the "*Miscellanies, or Mathematical Lucubrations of Mr. Samuel Foster, sometime Publike Professor of Astronomie in Gresham Colledge, in London*, 1659;" and on examining the curious tract contained therein, entitled "*Lemmata Archimedis*," I was agreeably surprised to find both the *enunciation* and *demonstration* of the property in question, annexed as a "Scholium" to "Propositio V." It is as follows:—

Scholium.

. . . . In triangulo *abg*, ducantur duæ perpendiculares, *bh*, *gd*, se mutuò secantes in *r*, et jungatur *ar*, et ducatur ad H, erit perpendicularis super *bg*, jungamus *dh*, et erunt duo anguli *dar*, *dhr*, sibi invicem æquales. Quoniam circulis qui comprehendit triangulum *adr*, transit per punctum *h*, quia angulus *ahr* est rectus, et sunt in eodem arcu, et etiam angulus *dhb* æqualis est angulo *dgb*, quoniam circulis qui continet triangulum *bdg* transit etiam per punctum *h*, ergo in triangulis *ab*H, *gbd*, duo anguli *ba*H, *bgd*, sunt æquales, et angulus *b* est communis, ergo *a*H est perpendicularis super *bg*."

Which may be thus freely rendered:



Proposition.—In the triangle *abg* let there be drawn the two perpendiculars *bh*, *gd*, mutually intersecting in *r*; let *ar* be joined and produced to meet *bg* in H:—*ar*H shall be perpendicular to *bg*.

Demonstration.—Join *dh*, and since the circle which contains the triangle *adr* passes through the point *h*, because the angle *ahr* is a right angle; the two angles *dar*, *dhr*, are mutually equal, being on the same arc. Also the angle *dhb* = the angle *dgb*; since the circle which contains the triangle *bdg* passes also through the point *h*. Therefore in the triangles *ab*H, *gbd*, the two angles *ba*H, *bgd*, are equal, and the angle *b* is common; therefore the angle *a*H*b* = angle *gdb* = a right angle. Therefore *aH* is perpendicular to *bg*.

Q. E. D.

The preceding extract settles the difficulty. "Foster's Miscellanies" was by no means a sealed book during the latter half of the seventeenth and the beginning of the eighteenth centuries. Most of those who studied mathematics during these periods were possessed of as much Latin as would enable them to read the "*Lemmata*," and hence most probably the "*Miscellanies*" were the source whence the knowledge of the property was derived. To the commentator *Abi Alhonin Ali*, then, and *not* to Mr. Chapple, belongs the honour of having first *enunciated* and *demonstrated* this proposition.

THOS. J. WILKINSON.

Burnley, Lancashire. December 28, 1850.

THE ENGLISH GOTHIC STYLE.*

To call a thing *gothic* is not ordinarily a style of speech calculated to call up ideas of grace and beauty. Certain it is, however, that in that which is called the *gothic* style of architecture, and which has of late been advancing wonderfully in the favour of the English public, there is a singular absence of that rudeness and uncouthness which we commonly associate with the term. In fact, it is a very gross misnomer. We have now before us a collection of "*Gothic* Ornaments," which is a perfect treasury of grace and beauty, and hardly, if at all, inferior to the best repertories of classic times. To the architect, the designer, the sculptor—to every one, in short, who is in any way concerned in administering to the gratification of the public taste, in the

* "Gothic Ornaments, Drawn from Existing Authorities by J. K. Colling, Architect." 2 vols. Royal 4to. Illustrated by 209 Plates. G. Bell, London. 1850.

direction which it has now taken, this work must be invaluable. The care and pains taken in its production have been immense. It contains upwards of two hundred plates, filled with the choicest existing decorative subjects in stone and wood—drawn on a large scale, with all the plans and sections necessary to show even the minutest details of construction—and the whole so boldly executed, as at once to exhibit the characteristic features of the design and the effective *toute ensemble* of each original.

The sculptured ornaments of the style known as Early English and Decorated, occupy the foremost place in the work. Any one not previously familiar with these styles will be quite astonished at the simplicity and chasteness, combined with fancy of the highest order, which pervade the specimens here collected. Some fifty plates are also devoted to the *painted* decorations yet remaining in many of our cathedrals and churches, having survived alike the unsparing tooth of time and the hand of the fanatical spoiler. The gorgeous effects of gold and colour, contrasted with consummate skill, which some of these display, can only be duly appreciated by being seen. In the production of this portion of the work, no expense has been spared; and we feel certain that, had not printing in colour—that great improvement in the pictorial productions of our times—been brought to the perfection it has, this elaborate work could not have been presented to the public at less than five times its cost. Mr. Colling discusses at some length, and with a great deal of sound judgment and discrimination, the applicability of coloured decoration to architecture. We make the following interesting extract from this part of the work.

It would be superfluous to dilate upon the peculiar beauty of effect, and other advantages derivable from the use of polychromy in architecture. To the interior of buildings, beyond doubt it is particularly applicable, and serves to impart that genial aspect, which, in this country, is all the more desirable from the occasionally cheerless nature of its climate.

In churches, coloured decoration is peculiarly effective, and, when properly applied to roofs and ceilings, is far preferable to that monotonous and dingy stain, in imitation of old oak, with which deal, plaster, and other materials are so frequently overlaid. For the plain surfaces of walls also, what can be better than some simple diapered pattern, with texts of Scripture around the arches, and in other appropriate positions. For this purpose the ornaments may be of the simplest kind, stencilled, and mostly without gilding.

For the reredos of a church, screen, chancel ceiling, or any smaller portion, the painting may be of a richer character, and with a greater extent of gilding. But, as a general rule, a building should never be completely covered with painting, or the greater mass made very elaborate. Of course there are exceptions to this rule; but this is said more in reference to churches of that class of which so many have been erected of late years,—churches wherein oak roofs are out of the question, and the adoption of plastering for the interior plain surfaces becomes almost a matter of necessity.

That love of whitewash, to which the churchwardens of the last century were so pertinaciously addicted, was a puritanical notion, which was probably handed down to them from the time of the Reformation; and the sooner it is altogether got rid of, along with the white ceilings of our dwelling houses, the better.

Where, then, open-timbered roofs are of deal, let them be appropriately decorated with painting, instead of being blackened over to the colour of tar; and, where the walls are of plaster, let them be relieved by coloured diapers or other designs. Nothing is more suitable for the reception of wall painting than plaster; and, after all that has been said against its use, there is nothing so appropriate for the internal covering of the plain surfaces of walling. Let all mouldings, piers, arches, &c., be executed in stone, and the plain surfaces covered with plaster, and painted, no matter how simply, so that it be of good design. Moreover, this is quite in accordance with ancient examples. The painting in West Walton Church, Norfolk, illustrated in the first volume, plates 58, 62, 63, is executed upon plaster; and again, the plain surfaces of the groining from the passage leading to the Chapter House, Salisbury Cathedral, are all plastered upon rough stone, and the plastering is *jointed* in a brown colour, as it is at West Walton. Two specimens of the painting from this passage are given in plate 79, vol. i. The painting on the groining of the Chapter House, belonging to the same cathedral, is of similar character; and I have no doubt that the plain surfaces are also plastered.

The painting from West Walton—vol. i., plates 58, 62, 63—and from St. Mary's Church, Guildford—vol. ii., plates 39, 40, 44—is of very simple character, and gives a tolerably good idea of what the painting probably was in ordinary churches during the 13th century. The colours were very few, mostly red, upon a warm ground, with green and blue here and there, but used sparingly. The ornaments had a resemblance to tiles of that date; and in decorating a church of the early English period, many very beautiful diapers might be designed for walls, backs of arcades, spandrils of arches, &c., from tiles of that date. With this idea, two plates of tiles have been given in the first volume, plates 97, 101. These designs can generally be so arranged as to be stencilled in a very simple manner. The half-circle from the spandril of the nave arches, West Walton Church,—vol. i., plate 58,—affords a very excellent suggestion as to the manner of decorating the spandrils of large arches. It should be observed, too, that no gold or expensive colour is at all required for this early decoration; in fact, it would mar the beauty and simplicity of the whole if it were introduced.

In painting of the decorated and perpendicular periods, red, green, and blue were used profusely, and carved foliage was usually gilded. The general rules observed by the decorator in painting, of these periods, appear to have been very simple; one was that of continually changing and contrasting two of the principal colours, which is very similar to what is called *counter-change* in heraldry. This may be seen in the ground or back of the stalls from the Lady Chapel, Ely Cathedral,—vol. ii., plate 1,—the shaft on the left-hand side being green, and the ground, or back of the stall, red; while, on the right-hand side, it *vice versâ*,—the ground green, and the shaft red. Above, in the ground behind the figure of the bishop, the colours red and green again alternate with those below. In the canopy, and parts surmounting the whole, this rule is not so prominent. Among the painted rood screens of Norfolk it becomes very apparent: in the red screen from East Harling Church, the red and green of the double quatre-foil panel, given in plate 66, vol. i., in the next quatre-foil, completely change places;—that which is green in one becomes red in the next, and *vice versâ*; gold, black, and white retaining their places throughout without change.

In the example from Beverly Minster,—vol. ii., plate 37,—red is *counter-changed* with blue; it is more frequently the case, however, that blue is very much confined to the hollows of mouldings, and the soffits of small groins, as in the groining of the canopies of the font cover at Ufford,—vol. ii. plates 51, 52, 58,—and in the small groins from the rood screen, Tilbrook Church, and Bishop Beckington's shrine, Wells Cathedral,—plates 65, 82.

Another rule which was observed, but, with few exceptions, is, that positive colours, as red, blue, or green, are separated by either gold or white. For example, in the cornice from Bishop Beckington's shrine, vol. ii., Plate 82, the colours for the moulding are in the following order:

COLOURS DIVIDED BY GOLD OR WHITE.

1	Intervals of Battlements	*Red.*	2	Battlements	*Gold.*
3	Hollow	*Blue.*	4	Bead	*Gold.*
5	Riband on Bead	*Chocolate.*	6	Fillet	*White.*
7	Moulding	*Green.*	8	Fillet	*Gold.*
9	Hollow	*Red,*	10	Fillet	*Gold.*
11	Moulding	*Black.*	12	Fillet	*White.*
13	Hollow	*Blue.*	14	Foliage	*Gold.*
15	Bead	*Red.*	16	Riband on Bead	*Gold.*

In the groin above, the ground is blue, the hollows of the ribs white, with the outer portion red (see section of the rib on the next plate), and fillet gold. There are exceptions to this rule in the same groin, some of the hollows being all red, and joining the blue. In diapers of panelling and other parts, when the ground was of a positive colour, the ornament upon it was either gold, white, or black; gold and black, or white; and sometimes all three. See the examples in vol. i., plates 66, 88, and vol. ii., plates 73, 77, 102. On the contrary, when the *ground* was gold or white, positive colours were used upon it. As in the examples in vol. i., plate 40, panel from aisle, St. Mary's Church, Bury, where the positive colours are placed on a white, or a very light ground; and in Plate 54, groining from choir, St. Alban's Abbey Church, the red and green

foliage is upon a light, or nearly white ground. See also plates 91, 101, vol. ii.

In this again, a resemblance to the laws of heraldry is seen; in which it is a general rule, "that metal shall never be placed upon metal, nor colour upon colour;" for "arms composed of metals and colours together, were introduced, as well as to represent them at a greater distance as to imitate the military cossack of the ancients, who embroidered their titia, or cloth of gold and silver, with figures in colours of silk; and their coloured silk, on the contrary, with gold and silver.*

Black, however, does not always conform to this rule, but was often used upon colour, as in the examples already referred to—vol. i., plates 66, 88; vol. ii., plates 73, 77; and a further deviation is, that white and gold were sometimes used upon each other. But white, in decoration, cannot be termed a metal, as in heraldry. White, in that science, always indicating *argent.*

Black and white, used together, were of frequent occurrence, as in the black and white striped beads, which are so common in perpendicular work. In the roof at Knapton, plate 27, vol. i., the beads are black and yellow. The principal tone of this roof is yellow. The whole of the rafters, fillets, and plain parts are yellow; and the foliage, hollows, and figures, picked out in red and green.

Red and white were frequently used without any other colours, as in the roof of Ufford Church, plate 61, vol. ii. In the lower part of the rood screen from Tilbrook Church, vol. ii., plate 69, red and white is *counter-changed;* the fillets and foliage gold; stripe on beads and ground of tracery, black. It may be noticed, as being unusual at this date, that there is no green whatever upon this screen.

It has been already said, that carved foliage was usually gilded; but there are many exceptions to this rule, as in vol. i., plates 18, 27, 36, 37; and even, in some cases, where the leaves are gilded, the stems painted green, and berries red. Prominent fillets in mouldings were generally gold.

Much of the ancient painting was undoubtedly of very questionable effect, as in the example from Dickleburgh Church,—vol., i., plate 18; yet the majority of examples produce a rich and pleasing impression, and the effect of some of the diapers on flat surfaces is very good. In these, the ornament was always extended flat upon the surface, without that shading or appearance of relief, which is so often superadded in modern painting.

The lower panels of most of the painted rood screens of Norfolk and Suffolk were usually filled with paintings of saints, or the twelve Apostles. Many excellent examples are still remaining, and present valuable specimens of the care and attention that was paid by the mediæval artists upon every portion of their work. As a few, amongst other examples, may be mentioned those of Worstead, Trunch, and Ranworth Churches in Norfolk. The dresses of the figures in the latter are all very elaborately diapered on gold. Three examples are given from the robes of St. Peter, St. Jude, and St. Bartholomew, in vol. ii., plate 98.

Mr. Colling's work will be found altogether eminently deserving the notice of our readers. His exertions, it is but right to add, have been most ably seconded, in the engraving, colouring, and gilding departments, by Mr. Jobbins.

* Clark's "Introduction to Heraldry."

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING DECEMBER 26, 1850.

William Laird, of Liverpool, merchant. *For improvements in life-boats, and in apparatus for filtering and purifying water.* (Partly a communication.) Patent dated June 24, 1850.

The life-boat which forms one of the subjects of this patent is intended to be made use of in cases where a communication exists between the wrecked vessel and the shore by means of a hawser. It is about 10 feet long, made of sheet iron, and reduced inside to the length of about 6 feet, by bulkheads, forming water and air-tight compartments at each end capable of containing sufficient air to compensate for the displacement of the boat. The boat is decked in right over, with the exception of a hatchway in the centre, between each end of which, and of the boat, the deck is covered in with air-tight cases, which are termed "tripping cylinders," and have the effect of causing the boat to right herself when upset. The hatchway is provided with a cover having a handle inside, and is capable of being pinned down outside. Air holes are placed on one side of the hatchway, and at each end of the boat are strong rings for slinging it cradle-wise on the hawser when in use, and for drawing it backwards and forwards between the ship and shore. The first person that goes off to the ship in this boat will have to hold the hatch down over him by the handle

inside, and on getting on board will be able to assume the direction, or give instructions how to manage. By this means the whole of a ship's crew, passengers, and as much of the cargo as can be placed inside the boat, may be drawn to the shore, four adults in a boat of the above dimensions being taken off at each trip.

Claim.—The general arrangement and combination of parts shown and described, as used to effect the specific object of the invention.

The filtering improvements consist in placing in a cistern of water a close camber of porous stone, having an outer casing formed of perforated metal. The space between is filled with vegetable charcoal, through which the water passes before reaching the interior chamber. An air-pipe is provided to this latter, to admit of the water or liquid contained in it being readily drawn off.

Claim.—The combination of an outer jacket filled with an antiseptic substance for purifying the liquid from any disagreeable smell, taste, or noxious quality, with a second filtering medium of porous stone, or artificial stone, or other substance of a similar character, by passing through which the liquid becomes clarified.

Thomas Fulljames, of Old Kent-road, gentleman. *For certain improvements in machinery or apparatus for raising, lowering, and moving weights or other heavy bodies.* Patent dated June 26, 1850.

The principal feature of this invention consists in the application to a rack and lever, when employed as a lifting appparatus, of a click or paul, which, as the rack is raised by successive strokes of the lever, takes into its teeth and prevents it from receding, and at the same time releases the lever from pressure. The lever has its fulcrum in two moveable links, which are connected at their opposite end to the socket of the rack. The patentee observes that, although he has shown the best method with which he is acquainted for carrying his invention into effect, he does not mean to confine himself thereto, as modifications may be made without departing from the principle of his invention; he therefore claims constructing apparatus for raising, lowering, and moving weights and other heavy bodies, whereby at any time the weight and pressure may be removed from the lever. (Absurd.)

Joseph Foot, of Spital-square, Middlesex. *For improvements in bolters.* Patent dated June 27, 1850.

It has been hitherto customary to employ woollen yarn in the manufacture of flour bolters; but owing to the unevenness of such yarn, the meshes of the cloth become obstructed, and the operation of bolting is in consequence impeded. Mr. Foot proposes to substitute fine Italian silk, thrown in the manner of organzine, but with rather more twist, to make it as wiry as may be, for the material now used, either wholly (as both the warp and weft threads) or partially (retaining woollen yarn as the weft). The absence of projecting fibrous ends renders silk peculiarly adapted for the purpose; and it is said, moreover, that the quality of the flour is improved by its use.

Claim.—The employment of silk in the manufacture of bolters.

James Forster, of Liverpool, merchant. *For improvements in filtering water and other liquids.* Patent dated June 27, 1850.

The first part of this invention relates to the construction of filters, and the second to various methods of cleansing the same from any impurities which may have either covered their surface or penetrated into the body of the material of which they are composed.

Mr. Forster proposes to make the porous filtering vessel of a spherical shape, the two parts of which it is composed being first hollowed out and then joined together by cement or otherwise. This vessel is placed inside a strong close chamber, to which the liquid is supplied from a main or force pump, the pressure of which forces the liquid through the porous material into the hollow chamber, which is supplied with a tap for drawing it off. The outer chamber has also a tap, through which unfiltered water may be drawn off, and which further admits of this chamber being cleansed when requisite. Mr. Forster makes no claim to placing a porous filtering vessel within an open tank or cistern, this having been previously done, but states that this part of his invention consists in combining a porous vessel with an external close vessel, and suitable taps or outlets, so that the filtration and discharge of the liquid may be effected by the pressure of the fluid itself. One filtering vessel only is described as being placed within the close chamber; but for water-works, it is recommended to have several filtering vessels to each closed chamber.

When the porosity of the filtering medium is affected by the presence of aluminous earth or clay, the filter is to be immersed for from five to fifteen minutes in a hot solution composed of two fluid ounces of sulphuric acid, and a quarter of an ounce of nitrate of potash to a pint of water. The clay will be thus dissolved, and may be removed by washing with water. 2. If lime, or its carbonate in the state of chalk, be the

obstructing agent, it may be removed by the use of a solution of hydrochloric acid in water at the ordinary temperature. 3. In the case of oxide or carbonate of iron, muriatic acid and water, at the ordinary temperature, is recommended to be used. 4. Any oxide of lead may be dissolved by means of nitric acid in the proportion of three ounces to the pint of water. This mixture is to be used at a little above the ordinary temperature. 5. Concentrated sulphuric acid in a hot state is recommended for removing any carbonaceous or peaty matter. And 6. If the obstruction is caused by any oily or fatty matters, a strong solution of soda or potash in boiling water will have the effect of saponifying the fat, and rendering it easily removable by the use of boiling water.

Mr. Forster states that he does not intend to confine himself to the chemical bodies above specified, as other alkalies and acids may be used with like effects, but he considers them to be the least expensive of any.

Claims.—The application of chemical bodies in solution as solvents for those solid impurities which obstruct the action of filters.

CHARLES STARR, of New York, in the United States of America. *For improvements in bookbinding.* Patent dated July 3, 1850.

Claims.—(Under that part of the invention which relates to "backing" books.) 1. The use of a roller, of the whole or part of the length of the book, either plain, for a plain back, or grooved, for a raised banded back, which rolls over the back of the book from side to side, or from the centre to the sides, and has a yielding pressure applied to it by means of weighted levers, or their equivalents.

2. A peculiar construction of swinging clamp or holder, for the purpose of holding the book for backing, hung upon pivots or journals, and capable of swinging back and forth, so as to cause the back of the book to describe an arc of a circle, and present every part to the face of the roller.

3. A peculiar construction of gauges sliding upon inclined bars, so that they may be set to form guides for placing both ends of the back of the book at an equal or nearly equal elevation in the clamp, so as to cause each part to receive an uniform pressure, and may be drawn back from the book without dragging or rubbing the surface of the back.

(With regard to the second part of the invention, which consists of a new construction of machine, called the "back finisher," to be used for embossing, lettering and finishing the backs of books after they are "forwarded," or "in leather.") 1. The use of one or more circular engraved rollers of the whole or part of the length of the book, working across the back of the book, and having their pressure upon it graduated by weighted levers, or their equivalents, for the purpose of embossing, or gilding, or as it is technically termed, "finishing the backs of books."

2. Clamping or holding the book in a swinging holder, which hangs on pivots or journals, and is capable of being swung backwards and forwards, so as to cause the back of the book held in it to describe an arc of a circle, and bring each part of the back to the finishing roller, so that it shall receive an equal pressure all over its surface.

3. Forming circular gilding tools of any required pattern, by having a case or hollow metal cylinder fitting over a roller and provided with an opening cut in it of the required form of the panel or outer edge of the pattern, that part of the periphery of the roller within the opening in the case having any required number of small tools of suitable form or pattern secured to it, and the surface of the said tools standing up even with the outer cylindrical surface of the hollow case.

(With reference to an improvement in books for the use of the blind.) 1. Inserting thick strips of paper in the margin of the sheets, between the two leaves, the indented parts of the sheets being brought together, leaving a space in the back for a joint, and for admitting the twine in sewing, by which means the edges of the book becomes solid without pressure on the raised letters, the leaves of the book when finished appearing as if printed on both sides.

2. A peculiar arrangement and combination of mechanism, as described, whereby this object may be effected.

Gardissal's Patent.—The notice which we took in our abstract of the specification of this patent of the clerical defects by which it is disfigured and obscured, has produced the following note from the London Agent employed in the matter, which it is but justice to here insert:—

Dear Sir,—You have very properly, in your last Number of the 21st inst., censured the clerical errors and the unintelligible meaning of a specification for certain improvements in the manufacture of sulphate of soda, muriatic and nitric acids, enrolled the 11th inst. But I beg to state, and request of your kindness, to insert it in your far-spread paper, that no blame, though the patent is in my name, is to be attached to me, having had nothing to do with the above specification. A Mr. Gardissal, of Paris, for whom I passed the patent, did, on the 3rd inst., when I was in that city, serve me with an injunction by a judicial officer (*huissier*), requiring me, under penalties, to enrol the specification as he should hand it to me—"*sans y changer*

un seul mot"—adding, that it was prepared by "the most eminent chemist in London." It was with the greatest difficulty I could prevail on Mr. Gardissal's agent to insert that the invention was "a communication," instead of being, as they had said, *my* invention. The difference they apparently did not comprehend. May I add that, since the 11th inst., I have in vain asked the name of that "eminent chemist" who prepared the specification, in order that I might pay him my compliments on his scientific acquirements. I am, Dear Sir,

Yours very obediently,
P. A. De Fontainemoreau.

WEEKLY LIST OF NEW ENGLISH PATENTS.

George Edward Dering, of Lockleys, Herts, Esq., for improvements in the means of and apparatus for communicating intelligence by electricity. December 27; six months.

John Mathison Fraser, of Mark-lane, London, merchant, for improvements in the manufacture of sugar. (Being a communication.) Dec. 27; six months.

John Ransom St. John, of New York, America, engineer, for improvements in the construction of compasses and apparatus for ascertaining and registering the velocity of ships or vessels through the water. December 27; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the construction of metal shutters. (Being a communication.) December 27: six months.

Celeste Menontti, of No. 6, Rue de la Paix, Paris, gent., for certain chemical compositions for rendering cotton linen, woollen silk, and other fabrics, impervious to water. December 27; six months.

William Henry Jones, M.A., of Queen's College, Oxford, and of Chorley, Sussex, clerk, for improvements in apparatus to be used when burning candles. December 28; six months.

Thomas Symes Prideaux, of Southampton, gent., for improvements in generating and condensing steam, and in fire-places and furnaces. December 28; six months.

James Slater and John Nuttall Slater, of Dunscar, of Lancaster, bleachers, for certain improvements in machinery or apparatus for the purpose of stretching and opening textile or woven fabrics. December 28; six months.

LIST OF SCOTCH PATENTS FROM 22ND OF OCTOBER TO THE 22ND OF DECEMBER, 1850.

John Turner, of Birmingham, Warwick, engineer, and Joseph Hardwick, of Birmingham aforesaid, builder, for certain improvements in the construction and setting of steam boilers. November 20; four months.

Alexander Mein, accountant in Glasgow, trustee upon the sequestrated estate of the late James Smith of Deanston, North Britain, for certain improvements in treating the fleeces of sheep when on the animals. November 20; six months.

William and Colin Mather, of Salford, engineers, and Ferdinand Kaseleusky, of Berlin, Prussia, engineer, for improvements in machinery for washing, steaming, drying, and finishing cotton, linen, and woollen fabrics. November 21; six months.

Edwin Pettitt, of Birmingham, Warwick, civil engineer, for improvements in the manufacture of glass, and in the method of forming or shaping, and ornamenting vessels and articles of glass, and in the construction of furnaces and annealing kilns. November 22; six months.

John Mathews, of Kidderminster, foreman, for improvements in sizeing paper. November 22; six months.

William Radley, chemical engineer, and Frederick Meyer, oil merchant, both of Lambeth, Surrey, for improvements in treating fatty, oleaginous, resinous, bituminous, and cerous bodies, the manufacture and application of them, and of their compounds and subsidiary products, together with the apparatus to be employed therein, to new and other useful purposes. November 22; six months.

Jules Le Bastier, of Paris, but temporary of Frankfort on the Main, in Germany, gent., for certain improvements in machinery or apparatus for printing. November 27; six months.

Alfred Vincent Newton, of 66, Chancery-lane, London, mechanical draughtsman, for improvements in the preparation and manufacture of caoutchouc or India-rubber. (A communication.) November 27; six months.

Isaac Lewis Pulvermacher, of Vienna, engineer, for improvements in galvanic batteries, in electric telegraphs, and electro-magnetic and magneto-electric machines. November 28; four months.

Guilliaume Ferdinand de Douhet, of Clermont Ferrand, France, gent., for certain improvements in the disoxigenation and the mutual reoxigenation of certain bodies, and the application of the products therefrom, either seperately or simultaneously, to various useful purposes. November 28; four months.

George Benjamin Thorneycroft, of Wolverhampton, Stafford, ironmaster, for improvements in the manufacture of crank axles. December 2; six months.

David Napier, and James Murdoch Napier of the York-road Lambeth, Surrey, engineer, for improvements in apparatus for separating fluid from other matter. December 2; four months.

David Auld, of Glasgow, for certain improvements in steam engines, and in the working of steam boilers or generators, and in apparatus connected therewith. December 2; six months.

Jean Aimé Marnas, of Lyons, France, for improvements in the manufacture of indigo. December 2; six months.

Peter Wood, of the firm of Thomas Bury and Co., dyers, calenderers, and finishers, Adelphi Works, Salford, Lancaster, for improvements in figuring and ornamenting woven fabrics, and in machinery employed therein. December 4; six months.

William Melville, of Roebank Works, Lochwinnoch, Renfrew, calico printer, for certain improvements in weaving and manufacturing and printing carpets and other fabrics. Dec. 6; six months.

Peter Armand Le Comte de Fontainemoreau, of 4, South-street, Finsbury, London, for certain improvements in oscillating engines. (A communication.) December 7; six months.

Alfred Vincent Newton, 66, Chancery-lane, London, mechanical draughtsman, for an improved composition, applicable to the coating of wood, metals, plaster, and other substances, which are required to be preserved from decay, which composition may also be employed as a pigment or a paint. (A communication.) Dec. 9; six months.

Thomas Deakin, of Balsall Heath, Worcester, Esq., for certain improvements in rolling metals, and in the manufacture of metal tubes, also in apparatus and machinery in connection therewith. December 11; four months.

John George Taylor, London, merchant, for certain improvements in dress and other pins, and in other dress fastenings and ornaments. December 11; six months.

Robert Olddiss Bancks, of the firm of Bancks, brothers, of Weirhouse Mill, Chesham, Bucks, paper and card makers, for improvements in the manufacture of paper. December 13; six months.

George Edward Dereing, of Lockleys, Herts, Esq., for improvements in the means of, and apparatus for communicating intelligence by electricity. December 17; six months.

John Ransom St. John, of New York, America, engineer, for improvements in the construction of compasses, and apparatus for ascertaining and regu-

lating the velocity of ships or vessels through the water. December 18; six months.

Charles Hanson, and Charles Saunderson, London, engineers, for improvements in propelling. December 18; four months.

James Mather the younger, of Crow Oaks, Pilkington, Lancaster, bleacher, and Thomas Edmeston, of the same place, calenderman, for certain improvements in machinery or apparatus for scouring, finishing, and stretching cotton and other woven fabrics. December 20; six months.

Edward Dunn, of New York, but now residing in the London Coffeehouse, London, master mariner, for an improved engine for producing motive power by the dilatation or expansion of certain fluids or gases by the application of caloric. December 20; six months.

LIST OF IRISH PATENTS FROM 21ST OF OCTOBER TO THE 19TH DECEMBER, 1850.

Maxwell Miller, of Glasgow, Lanark, coppersmith, for improvements in distilling and rectifying. October 39; six months.

Charles Bury, of Salford, Lancaster, manager, for certain improvements in machinery or apparatus for cleaning, spinning, doubling, and throwing raw silk. November 4; six months.

Antoine Pauwells, of Paris, merchant, and Vincent Dubochet, of Paris, for certain improvements in the production of coke, and of gas for illumination, and also for regulating the circulation of such gas. November 11; six months.

William Palmer, of Sutton-street, Clerkenwell, manufacturer, for improvements in the manufacture of candles and wicks. November 11; six months.

Robert Lucas, of Furnival's-Inn, London, mechanical draughtsman, for improvements in telegraphic and printing apparatus. November 11; six months.

Etienne Joseph Hanon Valcke, of Belgium, miller, for improvements in grinding. November 13; six months.

Christopher Cross, of Farnworth, near Bolton, Lancaster, cotton-spinner and manufacturer, for improvements in the manufacture of textile fabrics, also in the manufacture of wearing apparel and other articles from textile materials, and in the machinery or apparatus for effecting the same. November 21.

Peter Armand Lecomte de Fontainemoreau, of 4, South-street, Finsbury, London, patent agent for inventions, for certain improvements in oscillating engines. December 7.

William Radley, chemical engineer, and Frederick Meyer, oil merchant, both of Lambeth, Surrey, for improvements in treating fatty, oleaginous, resinous, bituminous, and cerous bodies, in the manufacture and application of them, and of their compounds and subsidiary products, together with the apparatus to be employed therein to new and other useful purposes. December 7.

Lucien Vidie, of No. 14, Rue du Grand Chantier, Paris, France, French advocate, for certain improvements in measuring the pressure of air, steam, gas, and liquids. December 14.

Francis Edward Colegrave, of Brighton, Sussex, for improvements in the valves of steam and other engines, in causing the driving wheels of locomotive engines to bite the rails; and also in applying water to steam boilers. December 14.

Joseph Findlay, of New Sneddon-street, Paisley, Renfrew, North Britain, manufacturer, for improvements in machinery or apparatus for turning, cutting, shaping, or reducing wood or other substances. December 19.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Dec. 26	2600	J. Whitehouse & Son	Birmingham	Roller-blind furniture.
27	2601	The Hon. W. E. Fitzmaurice	Prince's Gate, Hyde-park	Metallic cloth and towel horse.
28	2602	T. R. Gardner	Glasgow	Drainage level.
„	2603	John Keyse	Cross-street, Newington-butts	Apparatus for saving lives from drowning.
30	2604	Capper and Waters	Regent-street	Sottanello, or under garment for gentlemen.
„	2605	John Suderwick	Prince's-street, Leicester-sq	Stem of a tobacco-pipe.
„	2606	Lewis and Allenby	Regent-street	Stella parasol.
„	2607	W. Richardson	Romford	Spring hat-lining.
„	2608	G. Marshall	William-street, Regent's-park	Portable screw-wedge door-guard.
1851 Jan. 1	2609	J. T. Hewes	Strand	Alterion, or life-boat.
„	2610	Charles Lamport	Workington	Steering apparatus.
„	2611	W. Middlemore	Birmingham	Mounthing rein.

CONTENTS OF THIS NUMBER.

Description of Messrs. Rosenborg and Montgomery's Patent Cask-Making Machinery—(*with engravings*) ... 1
Patent Law Reform:
Plan of the Society of Arts Committee ... 6
Plan of Mr. Thomas Webster., Esq., Barrister ... 7
Plan of the Association of Pattentees ... 9
On an Important Geometrical Theorem. By Thomas Wilkinson, Esq., F.R.A.S. ... 12
Colling's "Gothic Ornaments."—(Review.) ... 13
Specifications of English Patents Enrolled during the Week:—
Laird ... Life-boats and Filters ... 16
Fulljames ... Raising Weights ... 17
Foot ... Bolters ... 17
Forster ... Filters ... 17
Starr ... Bookbinding ... 18
Gardissal's Patent ... 18
Weekly List of New English Patents ... 19
Monthly List of Scotch Patents ... 19
Monthly List of Irish Patents ... 20
Weekly List of Designs for Articles of Utility Registered ... 20

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MESSRS. RANDELL AND SAUNDERS' PATENT STONE-SAWING MACHINERY.

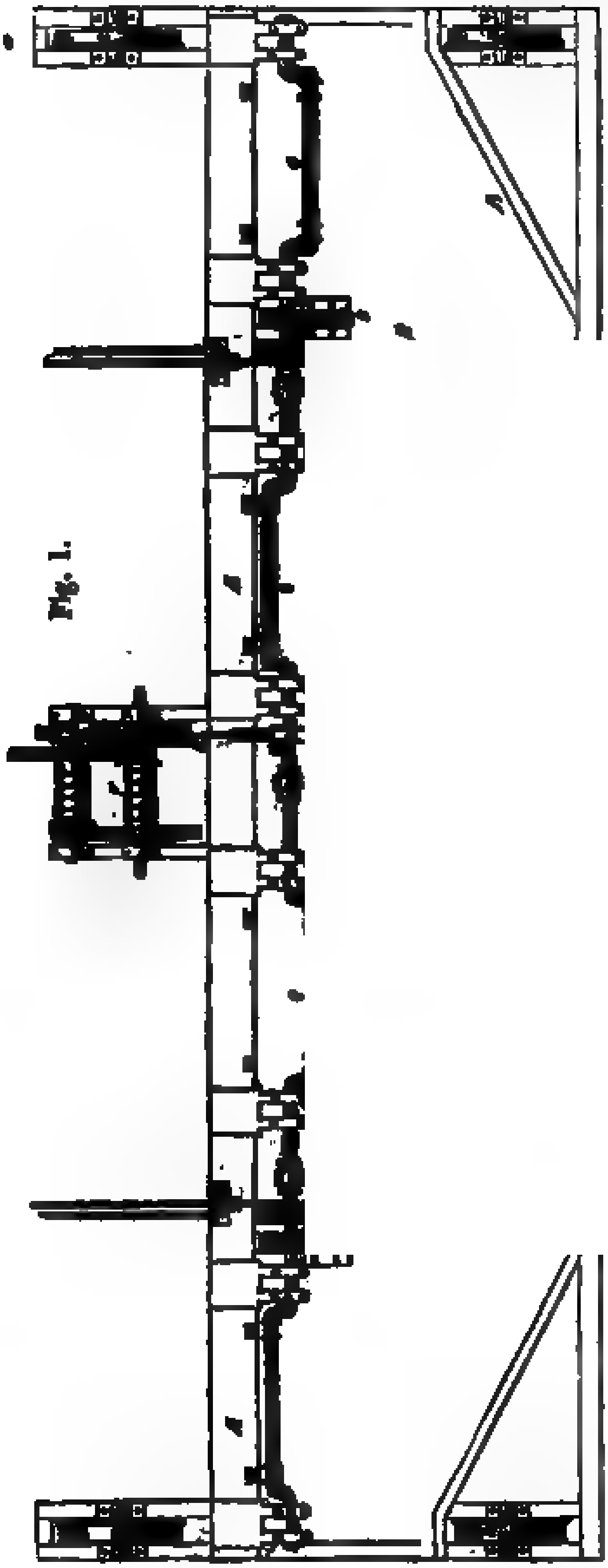

Fig. 1.

Fig. 2.

Fig. 4.

Fig. 3.

MESSRS. RANDELL AND SAUNDERS' PATENT STONE-SAWING MACHINERY.

THE most remarkable peculiarity in this machinery is its applicability to the sawing o stone *before* its removal from the quarry or other natural site; indeed, according to the best of our recollection, this is the first time such a thing has ever been done. Fig. 1 is a plan showing the general construction and arrangement of this machinery; and fig. 2 a side elevation of it. In the machinery as there represented, it is arranged for working eight saws simultaneously. A front elevation of so much of the machinery as includes a pair of these saws, and the parts in immediate connection with them is given separately on an enlarged scale in fig. 3, and an end elevation of the same on the same scale in fig. 4. The following is the description given of these figures in the specification of the patentees:—

A A is a frame of wood or of metal, which is mounted on flanged wheels BB, and is moveable to and fro on the rails R R. C is a cranked shaft which extends from end to end of the frame A A, and has its bearings in the bosses *a a*. L L are saw frames, one to each pair of saws, which are centred upon or swung from the same axis as the crank shaft; and turn in their bearings to any angle required, each independent of the others. I I are rods by which the cranked shaft is connected to the saw frames L L, and communicates a reciprocating motion to them. O O are the saws. D D are pulleys, which being caused to revolve by the ropes or chains H H, in manner to be presently explained, give motion through an intermediate wheel on the shaft C^2, to pinions *b b*, mounted on the same axis as the crank shaft, which again turn the driving-wheels E E, attached to the crank shaft C. The ropes or chains H H are worked by means of a driving-wheel and slack pulley (both left for sake of convenience out of the figures), the former of which is placed at a little distance to the rear of the machine, say twenty or thirty yards, and the latter at a like distance on the opposite side, or in advance of the machine. Motion may be given to the driving-wheel either by hand, horse, or steam power. F is a double barrel winding apparatus, by which the frame A A is moved forwards or backwards as required. It is worked from the crank shaft by means of the eccentric G, and connecting-rod G′; but as no claim is made to the construction of this apparatus, and the same effect may be produced by other means, as, for example, by weights and pulleys, and even by manual labour, it is unnecessary to enter into any detailed description thereof.

To enable the whole of the saws to act independently of one another, and each to yield to any extent required by circumstances, without interfering with the action of the others, they are fixed on the frames in the manner particularly represented in figs. 3 and 4, and further illustrated by figs. 5 and 6. K is a slide plate which extends across each saw frame, and is of the form shown in the sectional plan, fig. 5. The rods J J, which connect the crank shaft and saw frames together, are attached to the back of the middle cross piece of this plate, as indicated by the dotted lines in fig. 3. M is an inner side plate, to which the saws are more immediately attached; this is fixed at right angles to the other plate K, and inserted in a recess made for it in the latter. A sectional elevation of this inner plate M, is given separately in fig. 6, on the line *x y* of fig. 5; and by comparing this sectional view with the form of the recess in K, in which it is inserted, its construction will be readily understood. N is a small cylinder, which contains a coiled spring *n*, which abuts against the head of the plate M, but is capable of collapsing to the extent of about seven or eight inches, which is about the diameter of the circle described by the crank. In the event of the saw's encountering any obstruction, the spring yields to the upward pressure of the bearing plate M, and so prevents any warping or twisting of the saw. P is a cross pin which projects from the plate K, and takes into slots in the plate M, and prevents the plate M from descending too far. The saw frames are fixed at the angle to which they are set by means of a quadrant Q, which is connected at one end to the frame, and works at the other end through a slot in a beam W, dropped from the frame A. The quadrant is perforated with a number of holes, and by passing a pin through any of these, and through a corresponding hole in the end of the beam W, the quadrant, and consequently the saw frame, are fixed in the position desired.

The mode of working with the entire machine is as follows:—Supposing the body of rock to be cut is open or accessible on one side, the machine is wheeled (either by means of the winding apparatus F or any other suitable machinery or means) in front of the place where the cuts are to be made with the saws at an angle of about 45°, or such other angle as may be required. Motion is then given to the crank shaft C; and as the saws enter the rock, the carriage is made to advance by the contemporaneous action of the winding apparatus F, or any other machinery or means that may be substituted for it, as before suggested.

The saws must, as in the case of ordinary sawing, be freely supplied while at work with water, or water and sand, as usual, and the different bearings be also kept well lubricated.

What the patentees specially claim in regard to this machinery, is the mode of bringing the machine to its work; the centreing of the saw frames, and the crank shaft by which they are actuated, on one and the same axis; the arrangement for driving the saws from one end only; and the manner of fixing the saws, whereby each may in its movements neither affect, nor be affected, by the movements of the others or any of them.

INDUSTRIAL EDUCATION.

There can hardly be a subject of more interest to mechanics of all ranks than that of the education of their children, and much as it has been discussed as a general question, it might be supposed that a comprehensive view must already have been taken of the principles on which an efficient education should be grounded; it does not, however, appear to have been so within the present century. True, the notion is beginning to be exploded that education consists in imparting the power of reading, writing, and arithmetic, and in consequence *industrial* training is now being introduced in a few pauper and ragged schools; but it does not seem that any such beneficial innovation has as yet been extended to children of the higher classes. Unfortunates, all but the very poorest children, are still chained to their desks from their first entrance in a school, till they arrive at age for apprenticeship, scientific pupillage, or the University. It is well known that the aptitude of youth for acquiring skill in any calling, art or science, is eminently increased, by early employment of both hands and mind in preliminary operations, analogous to those which are to constitute the business of their maturer years; why, then, should not instruction in useful arts and sciences be imparted in schools for the offspring of the independent classes? Especially that honourable class, the industrial, who by energy and thrift rear their children without gratuitous aid; nay, also, the children of the gentry, seeing how many of these can look forward only to their own exertions for the acquirement of independence.

Impressed with the benefit that would result to society at large were industrial training very generally introduced, Sir Samuel Bentham, so long ago as the year 1793, devised a "School of Arts," in which an education should be given that would prepare children for a great variety of useful employments. The plan was appreciated by many leading philanthropists of that day, amongst others by John Julius Angerstein, Esq., who took an active part in forwarding the project, which was for the education of many hundred children under the same roof. By that gentleman's exertions the plan was about to be made available before Sir Samuel's leave of absence from Russia should expire, but it was put an end to by his having been prevailed upon to re-engage in the naval service at home,—the duties of the new office created for him, engrossing the whole of his time. It happened, however, that his literary friend, the celebrated Etienne Dumont, struck with the eligibility of the plan, drew up a memoir descriptive of the projected "School of Arts," a portion of the introduction to which seems not irrelevent to the present communication. Dumont's introduction was in part as follows:—

"No objection can be made to a plan of education for those who subsist by the work of their hands, when the dominant objects of the plan are those of augmenting their dexterity, multiplying their employments, consequently their resources, giving them habits of frugality and industry—to instill, in a word, every thing that concerns working industry, and to connect with it all the development that can be given to their intellectual faculties. Thus the centre to which all would tend would be to diversify employment, to expand the mind, to render it intelligent and capable of modification. Reading, writing, drawing, and some other branches of instruction should not enter into their education as the *object* of it, but as the means of giving perfection to labour, whereby to augment the ease and the wealth of the people, and consequently to diminish the dangers, the seductions, of so many kinds by which they are surrounded. I know not to what degree benevolence

towards mendicity should be extended, but certainly it should have its limits; whilst on the contrary, there can be only good, without any risk, in that which favours those who work."

The institution of a school of the projected description, would still be of immense value to many a worthy parent, including widows knowing not where to place their orphan sons; it was to have included board, lodging, clothing, &c., and apprenticeship in some remunerative calling—but the object of the present communication is confined to a scheme of industrial training less vast, and such as might be introduced (it is apprehended) with facility.

Although religion be the only safe foundation on which secular education can be erected, yet this important subject is not herein enlarged upon; since the means of instilling piety are, happily, already in full view, and in full practice in seminaries of education. It must be borne in mind throughout the following remarks, that religion is intended as the ground-work of the education they propose, without which essential foundation, no success in the superstructure could be expected.

Convinced that industrial training should commence at a very early age, it was proposed that both in the School of Arts, and naval seminaries designed by Sir Samuel, children should be taken as early as six years old; nor is this so early as industrial habits have already been instilled; Count Rumford insisted on the advantages of giving habits of industry even to infants; therefore in the infant schools which he so successfully established at Munich, he took care to present to the youngest children, some older ones occupied in useful works. Imitation, he says in his works, is a prepondering inclination in children; the tiny ones in his school looked longingly at the employment of their elders; and after a little the young ones were as a favour allowed to work likewise. Thus needlework and knitting became pleasures instead of tasks; and so might handicrafts become to boys, were the practice of industrial operations placed before them, and the joining in them permitted as a reward. Now, work is presented to young imaginations as a misery to which their position in the social scale will afterwards subject them, desirable as it is to diminish the bitterness in idea of a life of labour.

A powerful reason for introducing manual operations into schools is that in childhood frequent change of occupation, especially from sedentary employment to some other which exercises the limbs, is as essential to the bodily health and strength of a child as it is consonant to his present enjoyment. Why then not turn this propensity for variety to good account? Why not provide that sedentary studies in all schools should be varied with a little carpentry, smithery, or gardening?

At present masters of boys schools are not competent to afford instruction in useful arts, although the mistresses of girls schools superadd to what may be termed literary attainments, the industrial arts of needlework, knitting, &c. The mysteries of the needle exceed those of the saw and the hammer; it is more difficult to make an eyelet-hole in linen than a gimlet-hole in wood. A schoolmistress is expected to make able sempstresses of her pupils, whilst a very inferior amount of dexterity in handicrafts would predispose a boy for the acquirement, on leaving school, of any art or manufacture to which he might be put. Competency to give preliminary instruction in some two or three arts—carpentry, smithery, gardening, for example—should therefore be considered qualifications as requisite for a schoolmaster, as knitting and needlework are for a schoolmistress.

It may be objected to the employment of part of a boy's time in handicrafts, that a sufficiency would not remain for the acquirement of reading, writing, and other literary attainments. Referring again to writing-schools—the National-schools for example—the girls in them are as fully instructed in religion, morality, reading, writing, arithmetic, &c., as are the boys; yet half the girls' school hours are employed in needlework. In a much higher description of school, that at King's College (London), a considerable number of boys, though studying many sciences in addition to ordinary literature, still have time during the usual school hours, to practice the manipulation of various materials, and to bring them into form and conversion for some useful article. Thus experience proves that the school-time of a

child is abundantly sufficient for both literary and handicraft instruction.

In the last number of the "Edinburgh Review," the advantages of industrial schools for paupers are forcibly pointed out: it is proved that by means of industrial training pecuniary savings have arisen in addition to the present happiness and future welfare of the children. In Limehouse training school, for example, apprentice-fees are no longer given with the children trained there, yet applications for them are more numerous than the establishment can supply. In the account given in the same Review of the "United Industrial School at Edinburgh," the children's delight in handicraft works is specially mentioned, and the gratification afforded them by the operations at a turning-lathe dwelt upon. The Reviewer justly observes, that some practice in the use of tools is eminently desirable, and that where emigration may be in view, capability of chopping up a log of timber, and of converting it into a rude table or bench, cannot but contribute materially to comfort in back settlements. It might have been added with equal truth as to those who remain at home, that, independantly of facilitating skill in handicrafts generally, the enabling men to spend an evening in fabricating some useful addition to home comforts, is a powerful means of weaning them from the dissipation of the gin and beer house.

Though the industrial establishments of naval seminaries, devised by Sir Samuel, were never instituted, determined on, as their introduction was by both Earl Spencer and Earl St. Vincent, yet when the Wood-mills in Portsmouth Dockyard were under his sole management, he caused an industrial training to be given to several young boys. The very success of this measure caused its discontinuance after some years. Mr. Burr, the master of those mills, represented that he could not retain these children, as they were enticed away by townspeople of all callings, to be taken as apprentices, on account of their acquired habits of industry and application, in preference to any other boys.

The difficulty of introducing industry in schools could not be so great as might be supposed. There seems various ways in which it might be accomplished; were some of the great master manufacturers, for example, to foster such a scheme, the experiment might be made by them with little of either trouble or expense. Some of those gentlemen have many hundred workmen in their employment, most of whom, without a doubt, would be very grateful were a school established where useful art might be acquired in addition to the usual literary education. *Gratuitous* education is not contemplated, since eleemosynary aid of any description destroys the praiseworthy sentiment of independence, and reliance on a man's own exertions. But such a school should be regulated, so that good instruction should be afforded at the smallest possible cost. Were some hundreds of children taught together, a master of superior intellect and tact might be afforded. Pupils, excepting those of the most advanced class, could as well be instructed by the old expedient of monitors, as by the master himself. Lancaster managed and instructed his school of many hundreds by means of the scholars themselves, one of each class teaching, the class immediately below his own. The rapid advance of all the scholars was remarkable; and if at the latter part of Lancaster's career the school became inefficient, this arose not from the plan itself, but from some self-conceit in the master, and a diminution of his own exertions.

In "Chambers' Edinburgh Journal," of the 26th of October last, an account is given of a school at the Hague; the number of scholars 776, yet besides the master there were no more than seven teachers. The children were instructed in reading, writing, arithmetic, (including the higher rules,) geography, and singing. The manner in which instruction was given, as related by Chambers, seems to preclude the idea that there was any assistance from monitors, excepting that the child at the head of each class collected and piled away the books that had been used in it; yet the order and quiet in the school is remarked with eulogy; there was no noise nor confusion on leaving school; "the same quiet characterized the whole proceedings; there was none of that deafening din so prevalent in English schools, as though noise were essential to knowledge; not a voice is heard, except that of the teacher, and any pupil who may be reciting."

From these examples it may be infer-

red that the general habit in "English schools is to engage a far greater number of teachers than are necessary, and that hence expense is incurred, so great as to deter private manufacturers from establishing such an industrial school as is proposed. Indeed the expense actually incurred in some of the best pauper schools appears to be enormous: for instance, in that at Swinton, near Manchester, the salaries annually paid amount to no less a sum than 1,800*l.*, exclusive of board to most of the persons engaged. The value of that board must surely be equivalent to the whole pay that would be required for persons having only the bodily care of the children in charge, so that the 1,800*l.* may fairly be considered as the cost of tuition; divide this sum by the number of children, 630, and the annual expenditure for the tuition of each of them will appear to exceed 2*l.* 18s.—upwards of thirteen pence a week. Now the fact is, that *private* schoolmasters give a good, or a superior, education to their pupils, at from sixpence to a shilling a week, and consider themselves sufficiently remunerated.

A school of 500 children, at 6d. per week each, would give an annual sum of 650*l.*, which might be expended as follows:—

Rent of School-house	£150
Master	100
Two Assistants, at 50*l.* each	100
Gratuities to Pupil Teachers	50
Master of Arts and Manufactures	100
One Assistant	50
Wear and tear of tools, materials spoiled, deficiency by occasional absence of pupils, and other contingencies	100
Total	£650

The master for general management need not be required to have experience in the use of tools—his department in instruction might be confined to the literary; but his assistants might be expected to have some knowledge of handicrafts, such as carpentry and smithery, so as to be competent to give rudimentary instruction in these and in some of the other common arts of life.

Should no master manufacturer be found to patronize such a school, it can scarcely be doubted but that qualified individuals would find ample remuneration for their time and trouble, by the institution of such an establishment for their own advantage. An intelligent man would easily acquire the use of tools so as to give rudimentary instruction in their employment. His workshop need not be spacious, nor the number of tools great; for the pupils might be at the same time, some at their desks, others at the benches or forge—thus alternately occupying the one or the other; so that neither desks nor benches need be as numerous as the number of pupils. A little time and a little experience might be necessary, to organize well the alternation of employments; but in how few cases has perfection been obtained at a first attempt! Neither would the cost of materials be an obstacle;—a sixpence-worth of fire-wood would go far in making pegs or garden tallies; and a pound of iron in forging tacks or brads. Pupils advanced in the use of tools would require some of a superior kind and better materials: their parents would in most cases, as is the custom at King's College, provide materials for articles their sons might manufacture, and would be well repaid when the box or the chair were brought home in a finished state. Experience has shown, too, with what pleasurable sensations a boy strives to fabricate well some article for home use,—with what delight he receives his parents' approbation of his handiwork; and, what is still of greater importance, it is by such trivial circumstances that domestic affections are developed in early life, and lead to the morality in future years, so rarely found but in those who love their homes.

Taking another view of an industrial school; its products might be made to defray a part of its expenses. In many girls' schools, the children's needlework brings in no inconsiderable sum; so might the produce of boys' industry. Amongst Sir Samuel's papers, there remains a list of articles in which very young children might be beneficially employed in a naval seminary, as well as usefully in respect to their own education. Those employments in a *naval* seminary were, of course, such as were subservient to the business of a naval arsenal,—such as twine-spinning, peg-making, nail-straightening. The last of these operations, introduced by the late Sir Henry Peake, saved to Government

no less than 800*l.* a year, as most of the nails were those collected on ripping-off copper sheathing; this shows what the earnings of boys may be—for those employed were all paid at a fair rate for their labour, and the amount accounted for previously to the return of 800*l.* as the annual savings. In Sir Samuel's list of employments suitable for children in a school of arts, a far greater variety of works were enumerated,—amongst others, the making of toys. This class of works he considered as peculiarly suitable for juvenile hands and minds; the materials requisite are most of them but of little value,—the loss not great if destroyed in working up. Toy-making he considered as initiatory to all the different varieties of works in wood, in metals, glass, leather, paper—materials, in short, of every description. Toys admit of many different degrees of perfection; if coarsely wrought and put together, still at a low price they find sale; those of good materials, well worked up and combined, obtain prices in proportion to their excellence. Though the variety of toys be already so great, still there is abundant room for new inventions; thus clever children might be expected to set their wits to work at an age when boys usually have no means of exercising the inventive faculty. The manufacture of toys has the farther advantage of being amusing to children, and that the bulk and weight of toys are in proportion to the size and strength of juveniles.

Tayloring and shoemaking have not been lost sight of: they are arts which grown-up men, from the highest to the lowest, might on some occasions find very useful; but they are *sedentary* employments, therefore do not answer the purpose of giving exercise, or perhaps sufficient variety to engage pleasurably the young mind.

Those who have paid much attention to the effect of day-schools in the metropolis, can hardly fail to have observed the temptations to which unattended children are exposed on their way home, noon and evening; and most desirable it seems, that this evil should, if possible, be obviated. The "Christian Brotherhood" in France place the boys in their schools, under the care of monitors to see each boy safe under the parental roof, besides which, one of the brethren usually accompanies some one party of the scholars. Might not some such regulation be useful for English schools? The great increase of *juvenile* depravity is noticed and deplored in all our courts of justice, and much of it is attributed to the mischievous influence of casual street associates.

The seeing a boy home might do much towards the prevention of this evil; but it is not sufficient where the parents have both of them to earn their daily bread, or where a father's authority might be required in addition to the mother's gentle admonitions, What farther measure can then be devised to promote the morality of the rising generation? It is at home that domestic virtues are the most certainly acquired, therefore the children's evenings can nowhere be so well spent as with their parents; but where the father, at least, is absent from six in the morning till six at night, it might be desirable that the school-hours of his boys should be made to coincide, as far as possible, with the hours of his own labour. Not that the children should be kept for twelve consecutive hours to particular studies, or specific works, however the kinds of it might be varied in the course of the day—some exercise of free will is as good for children as for men. Besides the times proper to be allowed for meals, some should be set apart for what is called play—though the hours of recreation are as much in want of supervision as any others can be: perhaps still more so, for the prevention of quarrels and the indulgence of vicious propensities. In some instances parents might furnish the child at parting in the morning with provisions for the day; in others arrangements with the schoolmaster might be made for *day* board; as is practised in some schools of a superior order. A play-ground, it is true, would necessarily have to be provided; there the plays themselves might be made highly conducive to a good industrial education—gymnastic exercises of some kinds, for example. What could more tend to the future safety of the embryo-bricklayer, mason, or house-carpenter, than practice in mounting and descending ladders, obtaining early a steady head and steady foot in walking along a narrow plank; the swarming up or down a scaffold pole, or the catching of a rope to save a fall?

Some boys might more willingly employ their hour of recreation in fabricating some trifle according to their own fancy; they might be allowed to do so, perhaps using tools that had been acquired as school prizes. Studious pupils might prefer reading some rudimentary scientific publication; others reading aloud some merry tale, or interesting sad story—and were children taught to read aloud, with the inflections of voice suited to the subject, instead of with the usual school drawl, a young reader so habituated, would draw around him a charmed audience from amongst his juvenile companions. Such, and many other amusements, might be introduced, harmless at least, if not decidedly instructive; and human nature is not so depraved but that most children would prefer such pleasures to chuck-farthing, throwing stones, or tormenting animals.

It may be objected to such a scheme, that schoolmasters of the description required are not possessed of means for obtaining the requisite *stock in trade*—if the outfit of a little library and gymnastic sundries can be so called. In these they might receive assistance; and were the scheme to be appreciated by some of the active philanthropists of the present day, it may be hoped that funds would not long be wanting to establish at least one such school. Assistance of this kind to the *master* would not have that demoralising effect on the honest mechanic, or on any of the industrial classes, which has been found to result from eleemosynary aid of any description, when coming in lieu of a man's own honourable exertions. M. S. B.

ON IMPOSSIBLE EQUATIONS. BY ROBERT HARLEY, ESQ., MEMBER OF THE MANCHESTER PHILOSOPHICAL SOCIETY, ETC.

Sir,—I beg to hand you for publication the accompanying papers, by Mr. Harley.

In a paper published at pp. 281-3 of the *Philosophical Magazine* for October, 1850, I gave—what I believe had never before been given—a complete discussion of GARNIER's equation, which places it in a new, and important, and interesting light. Towards the conclusion of my paper, I alluded to an equation which I have partially discussed at p. 125 of vol. li., of the *Mechanics' Magazine*. In a letter dated Taunton, Oct. 5, 1850, and which I received on the 7th of last month, Mr. R. Harley made the following most ingenious remark on that equation:—

"Regarding the equation

$$\sqrt{x}+\sqrt{x+1}=0,$$

permit me to remark, when

$$x=\frac{n^2}{1-n^2},$$

n denoting negative unity,

$$\sqrt{x}+\sqrt{x+1}=$$

$$\frac{n}{(1-n^2)^{\frac{1}{2}}}+\frac{1}{(1-n^2)^{\frac{1}{2}}}=\left(\frac{1+n}{1-n}\right)^{\frac{1}{2}}=$$

$$\left(\frac{0}{2}\right)^{\frac{1}{2}}=0.$$

Of course I bear in mind that

$$\frac{n^2}{1-n^2}$$

belongs to the 'new species of imaginary.'

"R. H."

Let me add that the value

$$x=\frac{1}{n^2-1}$$

would equally satisfy the given equation, and that, as it appears to me, such a solution as that given by Mr. Harley is only possible where the roots of a given equation are infinite, or zero. This possibility arises from the fact that zero and infinity are what the Rev. T. P. Kirkman has (*Phil. Mag.* for October, p. 296,) proposed to call *bisignal univalents*, or *bisignals*.

I am, Sir, yours, &c.,
JAMES COCKLE.

2, Pump-court, Temple, Oct. 3, 1850.

Letter from Mr. Harley to Mr. Cockle.

"College, Taunton, Oct. 31, 1850.

"My Dear Sir,—I take the liberty of sending you the accompanying papers on Impossible Equations, and shall feel greatly obliged by the expression of your opinion concerning them at your earliest convenience. The peculiarly pressing nature of my professional engagements has prevented me from giving to the subject that close and careful consideration it so well deserves; and I must therefore beg that you will regard with indulgence any defects that you

may observe in perusing these hurried investigations. Should you approve the principles I have premised, probably I may trouble you again in the course of a few weeks, with discussions of the equations

$$Ax \pm \sqrt{Bx^2 + Cx + D} = E.$$

$$(\text{and } Ax^2 \pm \sqrt{Bx + C} = D.)$$

You will observe that I have adopted your definition of an impossible equation. I have thought proper, however, for obvious reasons (art. 4), to depart from your definition of an impossible expression. Thanking you for your many kindnesses,

"I remain, my Dear Sir,

"Yours very faithfully,

"ROBERT HARLEY."

"To JAMES COCKLE, Esq., M.A.,
Barrister-at-Law."

On Impossible Equations.

1. When a surd equation is presented for solution, the symbol of radicality ($\surd$), which enters into it, is generally understood to be restricted to a *positive* interpretation; and hence any value of the "unknown" which will only satisfy such equation by giving to this symbol a *negative* interpretation, is not accepted as a root.

2. In the following brief investigations, the sign of radicality is invariably restricted—in the solutions as well as in the given equations—to a positive signification; for it is manifestly unphilosophical to confine its signification in one case, and to extend it in another; and besides, it is easily proveable that inattention to this obvious, axiomatic principle not unfrequently leads to false results.

3. For the sake of convenience, negative unity is denoted by the letter n. In order to prevent ambiguity or mistake, $(+1)^2$ or 1 is never substituted for n^2, except in those cases in which it is obvious that no error can result from the substitution.

4. By actual extraction,

$$\sqrt{a^2 + 2\,abn + b^2\,n^2} = a + bn.$$

Now when a and b are positive, and $a < b$, the right-hand member of this identical equation is negative, and therefore also

$$\sqrt{a^2 + 2\,abn + b^2\,n^2}$$

is negative—a supposition which is incongruous with the restriction imposed on the symbol $\surd$ in the discussion of surd equations (Art. 2). All such expressions as the preceding we shall therefore denominate *impossible expressions.* And, in like manner, every equation which can only be satisfied by the acceptance of such expressions, we call an *impossible equation.*

5. Negative quantities are made to assume a positive form by affecting them with n; thus—$a, -b, -c$, &c., where a, b, c, are supposed to be positive, are written an, bn, cn, &c. And, similarly, when a quantity is transposed from one side of an equation to the other, it is *multiplied* by n, and when re-transposed it is *divided* by n. By this means the distinction (in derivation) that exists between $(+1)^2$ and $(-1)^2$, or n^2, is never obliterated; and thus the foreign roots that frequently enter an equation, during its transformation, by neglecting this distinction, are effectually excluded.

6. Having laid down these preliminary principles and definitions, we proceed to discuss the equation

$$Ax + \sqrt{Bx + C} = D \ldots\ldots\ldots (a).$$

(*To be continued.*)

THE REFORM OF THE PATENT LAWS.

Sir,—I both presume and act upon the presumption that the columns of your Magazine are open for the free discussion of any subject that may be broached therein. I therefore trust that you will find space for the few remarks which I am about to make, even though I may find it necessary to differ with yourself as to the propriety of one or two observations which have dropped from your Editorial pen.

A reform of the existing Patent-laws, or the substitution of an entirely new system in lieu of them, is the alternative now offered to the public mind to choose from, and by consequence (as it is the fashion of the current era for the governed to dictate laws to the governors), to determine what shall in future be the law of the realm in reference to a copyright in inventions.

That there shall be a *change* of some kind or other, is no longer a moot point, thanks to the "Great Exhibition;" but the very exceptional character of the circumstance which has brought the

matter to a crisis should, in itself, be a sufficient warning to our Legislators to be cautious as to how they interfere with the *principles* of Patent-law, however desirable they may find it to reform, or even entirely remodel its practice.

On the ground that the main principles of Patent-law need not be abrogated, I most decidedly prefer the scheme propounded by the "Association of Patentees," &c., to that which has been brought forward by the Committee of the Society of Arts, although, both as a member of that Society, and an "intending exhibitor," I might otherwise feel a preference for the latter proposal.

As a whole, I think that the scheme of the "Association" is the clearest and most comprehensive plan of reform that has been put forth for some time in reference to any branch of law; and whilst it evidently shows a practical acquaintance with Patent-law as it stands, it also shows, by its extreme simplicity, an entire absence of what I believe I must call the *pettifogging* spirit which so generally characterizes legal reform. In this respect it contrasts most favourably with the plan put forth by Mr. Webster, whose mind is evidently trammelled by the system of practice with which he has been so long connected, and is so intimately acquainted.

Having given in a general adhesion to the scheme of the Patentees' Association, I must mention *one* particular in which, with some modification, I think the plan of the Society of Arts' Committee is preferable to that of the Association. It is the registration of an invention for a year on payment of a small sum, giving the inventor the option of completing his patent at the end of the year, or of dropping it. But whilst the Committee propose periodical renewals, I would have the inventor absolutely complete his patent at the year's end for a definite term—say fourteen years.

My reasons are simply these:—First, as to the desirableness of the preliminary registration, which, by the way, need not be *called* a "Registration," nor require a "Registrar," but be treated nearly as a "Caveat."

Inventions do not spring full-formed into existence, like Minerva from the head of Jove. They generally require, in order to their due perfection, even sufficiently for specification, a series of experiments and inquiries that would give rise to frequent occasions of disputed title, inasmuch as the requisite experiments could not be conducted without some degree of publicity; and I am sure you will at once admit that to compel an inventor to patent his crude or immature ideas, would be to subject him to manifest injustice, and to interfere most injuriously with the proper course of inventive ratiocination, not only in the particular case immediately affected, but also in all relative cases. Inventors would find themselves continually thwarted by the previous speculations of others, and the public would be always liable to be imposed upon by specious pretensions, as we see so frequently in America; whilst, on the other hand, it would be often deprived of really valuable inventions, because some imaginative person had patented an idea which he had conceived to be *possible*, to the exclusion of another who might have made it a practical fact. Either there must be a judicial inquiry before the grant of a patent, or the result which I have pointed out, with a long vista of litigation in the distance, must, I believe, ensue. Both consequences are undesirable; therefore I would give an inventor time, under protection, to perfect his invention before completing his patent.

Secondly, as to the modification of the Society of Arts' proposal. By this, I mean the *completion* of the patent at the end of *one* year instead of the system of periodical renewals, which latter seems to me to be open to considerable objection. There is a want of definitiveness about the renewal plan—one result of which will be that inventions will not be perfected so soon as they would be under a more rigid and more definite system—and frequently not at all. The energy which a new discovery gives to the discoverer, and which carries him through the obstacles that beset the early career of an invention, would often die out, or give place to other productions of a fertile brain. Thus the public would be alternately dazzled and disappointed, and would lose the advantages which might arise from the mature development of many a valuable idea; whilst the inventor would be led to throw off spark after spark from the poles of

his genius, producing no other result than a succession of evanescent flashes; in short, he would too often become a mere visionary speculator, instead of, as he might be, a public benefactor.

Another result would be that it would be seldom known to the public when a patent had expired under the renewal system. No such uncertainty would exist under the plan of the "Association;" under the latter, let the date of a patent be known, and it would also be known that at the end of fourteen years thereafter, the patent right would expire; whilst, if the renewal system should be adopted, the time would be uncertain when the public might use the invention without license from the patentee; and, consequently, infringements of patents would become common—in fact it would be difficult to avoid them.

I attach great weight to this objection. Even if the renewal of patents should be duly recorded or published, a person seeking to patent an invention, deemed by himself to be new, but involving any portion of an invention already patented, would not only have to search for the original grant, as at present, but also for the various renewals, in order to keep himself clear of the rights of others.

I have occupied too much of your space to venture now on any notice o- the other features of the reform pro posed by the Patentees' Association beyond a general expression of approval—especially in reference to foreign copyright, and the new system of enrolment, which I think is admirable.

You will, I think, pardon what I intend to be my concluding remark; that we should not quarrel with others who are working with the same object in view, although we may condemn their proposals. I feel assured that nothing but a conviction of the great superiority of the plan which you favour, and a consciousness of your entire disinterestedness in supporting that plan (both of which, upon the evidence of the plan itself, I can fully concede to you,) would have allowed you to express a suspicion of possible jobbery in any other proposal.

Jobbing, although too frequently, is not always a consequence of the reforms undertaken by amateurs.

I am, Sir, your obedient servant,

R. J.

[The scheme of provisional registration has at first sight a very plausible appearance; but it is open to more objections than our correspondent seems to have any idea of, or than we have here room to set forth; at some future opportunity we hope to be able to satisfy him, as well as others, that it would not answer. For the present, we shall but advert to one insuperable objection to it, which we do, because it has a direct bearing on the *partial* plan of provisional registration in regard to designs commenced on the 1st instant, and our noticing it now, may serve to put people on their guard against the false security it affords. It is this—that though provisional registration may protect you from piracy by your fellow-subjects, it cannot protect you from piracy at the hands of *all the rest of the world*; but is, on the contrary, establishing a sort of preserve, where all foreign birds of passage, *and they alone*, may help themselves without hindrance or restriction. Our correspondent takes exception, as a member of the Society of Arts, at the tone in which we have spoken of the labours of its Committee. We have dared to impute a spirit of jobbery to them! Yes; and this most advisedly. The Great Exhibition is acknowledged of all men to be a job—capitally managed and eminently popular, but still a most literal job. The Society's scheme for the overthrow (not the reform) of the Patent Laws arose out of that job (this "R. J." himself expressly admits), and has also been made a job of in its way. The best possible proof of this is the manner in which it has been carried out. Had the Adelphi leaders of this movement been actuated solely by public objects, their Committee would have been fairly and impartially selected;—they would have taken all such means as were open to them to get at the truth;—they would have given to opposing views a fair hearing and consideration;—they would have deliberated before they decided;—and, above all, they would have been careful to conciliate support by avoiding equally vituperation of institutions and of individuals. Now the contrary of all these things is in a remarkable degree true of this Adelphi affair. Of many gentlemen who are members of the Society, and well qualified by their knowledge and experience to be of service in such an inquiry, not more than one or two were placed on the Committee, and these, persons, who, on *other grounds*, it would have been better to leave out; while the Committee (and such as it was, no wonder) took no pains whatever to investigate the facts of the subject, but rushed to conclusions and into print, before there was even

time for inquiry; and they have produced a Report which, we will make bold to say, is without its match for general swagger and assurance of style—for historical ignorance, one-sided statements, rhetorical exaggeration, abuse of institutions and abuse of individuals,—all ending in a set of resolutions good for nothing, but smacking most significantly throughout of posts and appointments.—Ed.M. M.]

THE FLAX COTTON.

We are happy to be in a position to announce to our readers, with respect to the very interesting experiments now being conducted at Manchester, for the purpose of adapting the flax fibre to the existing cotton machinery, a further step towards their completion has been made by weaving some of the yarn spun upon cotton machinery. A quantity of the woven fabric has been kindly forwarded to us by Mr. Thomas Graves, to whose valuable assistance and practical experience are to be attributed in a geat degree the present successful state of these proceedings. The cloth was woven upon the circular loom invented by M. Claussen, and its texture is even and regular. The yarn from which the cloth is woven is composed of half flax and half cotton. M. Claussen now proposes to reduce the quantity of cotton, and try to spin it in the proportion of two-thirds flax fibre and one-third cotton. Arrangements are also in progress for spinning finer yarns than any which the inventor has yet succeeded in producing upon the machinery of Mr Bright, M.P. It is intended to spin it with the above proportion of flax and cotton up to 60's, and we shall not be surprised to hear in a short time, from what we have seen of the capabilities of the fibre under this particular form of treatment, that yarns of the pure flax fibre, equal to those of the finest cotton yarns, have been produced upon the existing cotton machinery.

The consumption of cotton in the last year at Manchester was upwards of 770,000,000 of pounds, or above 1,000 tons per day. The result of the experiments up to the present time is such as to show that flax may be substituted for one-half at least of this enormous quantity; and, in order to supply the Manchester manufacturers to this extent, the produce of 2,000 acres of flax would be required daily, or about 730,000 acres annually. The whole of the flax grown in the United Kingdom does not amount, in all probability, to one-seventh of that quantity; and the great difficulty in the way of an extensive application of this invaluable invention appears to be the totally insufficient supply of the raw material. We shall on a future occasion refer at greater length to this subject; but we cannot help expressing our earnest desire that the agriculturists of this country would consider, with that degree of attention which the subject deserves, the great importance, in a national point of view, and the advantages which would accrue to themselves, from their endeavours to supply to some extent the enormous demand which now appears to be opening up for the flax fibre.—*Morning Chronicle.*

MR. FROST'S EXPERIMENTS ON STEAM.

Sir,—Early in October I addressed you my thanks for inserting the Treatise on "Stame," &c., in your valuable work for March and April last, at the same time inclosing an Appendix and Supplement thereto.

In your Journal for October, I found a Treatise on Anhydrous Steam, by your learned correspondent Dr. Haycraft, of Greenwich, which, like all productions of learned men on this subject, contains a substitute of learning for knowledge, an intimate mixture of fact and fiction, while the earnest and sole endeavour of my work has been to show, that by separating fact from fiction, a most wonderful improvement may be effected in the use of steam.

The Doctor's term "Anhydrous Steam," or steam without water—is not only absurd, but a manifold impossibility, seeing that steam is at all times a definite compound of water and of heat, and "stame" but a slight modification thereof. Absurd, however, as is that term, his instrument, experiment, and result (vol. liii., page 289) is much more so, being absolutely impossible, as the steam therein must have been more than trebled in volume according to his own previous experiment,—showing that a volume of steam was increased ten-fold by the heat of boiling oil; and as the expansion of steam by heat has been found gradually progressive in all my experiments, and as those experiments have been often verified by inquisitive, intellectual, and competent judges, they

cannot fail on repetition by candid, competent, and unconceited judges. Then, again, see how they are confirmed by the Doctor's small engine, showing that more than ten times the useful effect was derived from heated steam, or "stame," than was derived from natural steam, and that a second larger engine of the Doctor's worked with surprising economy till the apparatus was destroyed by overheating it, and abandoned for that unnecessary cause; for surely if it was necessary to heat the apparatus, it was equally necessary not to overheat it;—to do so, then, was both absurd and foolish.

Again; to discover some mystery which never existed, the Doctor commences a diffuse and learned dissertation, by purposely misquoting instruments intended for a distinct purpose, 4 and 5 instead of Nos. 1, 2, 3, constructed for showing incontestably the matter in question; namely, that steam is easily and greatly expanded by a small addition of heat. In either of these instruments a very small drop of water is confined by a small column of mercury and atmospheric pressure, and the water being heated to form steam of greater tension than the load of mercury and atmosphere could confine, the superfluous water escaped. In fact, in No. 3 the steam was confined by only 21 lbs. per inch, while the expansive force thereof exceeded 2000 lbs. per inch. How absurd the idea of the Doctor, that all superfluous water was not expelled from the instrument, or that the several volumes and temperatures were not correctly recorded during the hour which elapsed in cooling the instrument and mercurial bath!

It is the learned Doctor's province to explain how he perpetrated so enormous an error; it may be easily shown he could not have practically experimented with such an ill-contrived instrument; for when immersed in heated oil, he possessed no other means of observing the volume of steam therein, than by withdrawing the instrument from the oil, when the cold air would instantly condense the "stame" to steam; for I have constantly observed, denuding the smallest portion of any part of an instrument in contact with "stame" destroys an experiment.

That so learned and ingenious a person, who has endeavoured so much to elucidate a discovery of such vast importance to mankind, should have failed so greatly, from some inadvertence, is exceedingly mortifying. I hope he will not, as is usually the case, feel aggrieved at this necessary exposition of his errors, for he may greatly console himself, by perceiving in my Supplement a much more idle conceit of Professor Renwick (who is here considered a perfect oracle) exposed, and fortunately exposed, for the exposition shows a still more useful fact than any recorded in my Pamphlet — namely, that immense profits of "stame" over steam may be obtained, in the lowest pressure and little heated engines that cannot be burned.

I have, therefore, again to request you to insert my Appendix and Supplement, if they have not already appeared, in * the *Mechanics' Magazine*, and in addition, this reply to Dr. Haycroft's paper:

At a future time I intend forwarding many other important matters that have occurred in my experiments on "stame"—one a description of a delicate instrument of glass only, in which any successive volumes of steam, all of exact equal magnitude and tension, and of different temperatures, and therefore of different weights, may be formed, and those weights may be accurately ascertained.

I shall conclude this, by stating that the different weights observed correspond so nearly with the different volumes found by the instruments as to afford satisfactory evidence of their general correctness.

I am, Sir, yours, &c.,

JAMES FOREST,

Engineer.

Fulton Avenue, Brooklyn, New York,
December 16, 1850.

DEATH, AND MEMOIR OF PROFESSOR DAVIES, OF WOOLWICH.

IT is our melancholy duty to record, in the present Number of our Journal, the DEATH OF PROFESSOR DAVIES. We pen this announcement with a feeling which we

* Inserted last volume, p. 391.

know will be participated in by a large number of our readers,—a feeling, allied to which a sense of personal bereavement could alone awaken. To ourselves, however, we must acknowledge, that the event was not wholly unexpected. For a long time we had regarded our distinguished friend as a dying man; and it will be a sort of sad satisfaction to our readers to know, that some of the most instructive and interesting of his communications to this Magazine were the productions of one on his way to the grave, under the pressure of a painful and hopeless disease—of one so prostrated by long suffering, that his physical strength supplied scarcely energy enough to guide his pen—an instrument, however, which he finally laid down only with his life.

He died early on Monday morning last, in the fifty-seventh year of his age. His complaint was inveterate bronchitis, aggravated by a more recent attack of influenza, with which his exhausted strength and attenuated frame was unable to contend. Till this new and formidable enemy assailed him, he was not without some faint hope of ultimate recovery. He had been earnestly entreated by his relatives and friends to discontinue his visits to the Academy upon the approach of winter: his conscientious scruples, however, led him for a time to resist, and he persevered in attending to the duties of his office—riding to the Academy in a covered vehicle — till within a few weeks of the vacation; when, finding himself too weak even to stand, he was compelled to yield, and to resign himself to his chamber. The repose seemed to be producing the hoped-for result, when the fatal epidemic already mentioned attacked his feeble frame, and destroyed the remotest expectation of recovery. He retired to his bed, and composed himself to die; and we have reason to know that he died as a Christian should.

It was a frailty—we hope a pardonable frailty—that even during the last few days allotted to him, he could not wholly abstract his thoughts from the pursuits and occupations in which all the vigour of his life had been spent.

His cough would not permit him to speak, except in detached monosyllables, delivered with apprehensive caution and in a whisper. In this way he would frequently give utterance to his anxiety about the unfinished productions of his mind, especially in reference to his contemplated Descriptive Geometry, and his contributions to the Woolwich Mathematical Course, now in preparation, and we believe in part printed. About this latter work he manifested much concern, as he had calculated upon being spared long enough to revise the proofs.

It would, we are persuaded, gratify our readers if we could here give a detailed account of the more important of the numerous scientific writings of our departed friend: the time, however, is too short to enable us to attempt anything of this kind in the present Number of our Journal. The productions of so voluminous a writer as Professor Davies—extending, as they do, over a period of five-and-thirty years—could not be pronounced upon with any degree of justice, either to him or ourselves, without deliberation and research. We may perhaps address ourselves to this task hereafter, and, assisted by our scientific friends, may probably be enabled to give at least a sketch of the objects and general character of his published performances. At present, we are not prepared with even a catalogue of these; and drawing, as we now entirely do, upon memory, without any of his papers, except those in our own Journal before us, can only mention the following few particulars.

Professor Davies's earliest productions—the first buddings of his fertile intellect—were, we believe, gathered into the garner of the *Ladies'* and *Gentlemen's Diaries*——those long-recognized receptacles of the first fruits of British scientific talent. To these publications—to "Leybourn's Repository," to the "Leed's Correspondent," and to the "Philosophical Magazine," he was a frequent contributor when but a young

man: two of these publications have long ceased to exist; but his connection with the others was uninterruptedly kept up till the time of his death. The current Number of the "Diary" contains his customary amount of contribution—a long and elaborate article on some subjects of geometrical speculation that had long occupied his thoughts and exercised his pen, both in that publication and in the "Mathematician"—"Radical Axes and Poles of Similitude." And, till within a few weeks of his death, he entertained the hope of having another portion of his historical researches, in reference to the Geometry of the Ancients, ready for the current Number of the "Philosophical Magazine."

It may be remarked here, that Professor Davies's acknowledged position as the first of British geometers, was not a position at which he had ever aimed; a glance at the earlier productions to which we have alluded, and also a reference to many of later date, will show that he had cultivated the modern analysis as assiduously as he had explored the ancient geometry; but the originality and elegance displayed in his geometrical investigations—the manifest extent of his reading, and the depth of his researches in matters of pure geometry—his successful treatment, and it may almost be said *revival*, of certain curious and recondite geometrical speculations—gave such evidence of power and erudition in this department of inquiry as could not fail to attract the especial admiration of men of science, and he came at length to be regarded as almost exclusively a geometer. Deferring to the general voice, he felt it to be a duty to sustain the distinguished character thus conferred on him; and, during the latter years of his life, he laboured for the most part in the field which he considered that others had assigned to him; and he laboured with scarcely a coadjutor, with scarcely a competitor, and, by general admission, without an equal.

A worthy tribute of respect was paid to his meritorious toil by the distinguished continental geometer, M. Chasles, upon his recent visit to England. One of his first objects was to search out Professor Davies, and to present him, with his own hands, an inscribed copy of his last great work.

But an examination of Professor Davies's contributions to science previously to the last ten or twelve years, will show that he was an able analyst, as well as a profound geometrician. His papers in the Transactions of the Royal Society of London, on Terrestrial Magnetism; those in the Edinburgh Transactions, on the Ancient Dials and on Spherical Coordinates, afford abundant evidence of this; as also do his shorter communications to other scientific periodicals. Many of his contributions to these were given anonymously, or under some quaint designation, as "Peter Twaddleton," "Shadow," "Pen-and-Ink," &c. Of late years these *opuscula* were committed chiefly to the "Mathematician" and to the pages of this Journal. But he wrote largely on subjects of a less purely professional and scientific character in other publications; and we believe that the very last paper of this kind he ever wrote appears as an article in the Number of the "Westminster Review," just issued.

But we cannot now enter into the subject of his writings; we pen this brief and hasty notice literally on the eve of going to press. We have found difficulty in making room even for this short article; but we could not allow even a week to pass by without publicly recording our sense of the loss which science in general, and this Journal in particular, has sustained by the lamented death of PROFESSOR DAVIES.

THE VICTORIA SUSPENSION BRIDGE, ON MR. DREDGE'S PRINCIPLE.

(From *Keene's Bath Journal.*)

The Caledonian Victoria Bridge, on the highest level of the Caledonian Canal (for common road traffic,) is 155 feet 6 inches span, and each arched entrance is 15 feet high. The piers upon which the chains rest are 84 feet above the ordinary level of low water, and built of solid rock masonry. The site is pretty and romantic, but subject

to heavy speats. Within the last thirty years, from the violence of the mountain torrents, on the same spot there have been three bridges destroyed—two of timber, and one of granite; but the plan now adopted can never share the same fate, as it admits for the current entire freedom the whole breadth of the river, and the roadway is 8 feet above the highest flood level. This is the second extensive bridge connecting the banks of Glen Albion, erected within the last twelvemonths by Mr. Dredge, of this city, on the principle of the balance on tension; and as they are built of the best iron and granite, they will endure for centuries. The great peculiarity of these bridges is the tapering the chains from maximum, at the top of the piers, to nothing at the centre of the bridge, by which is attained the maximum of strength and stability at the least possible expenditure of material. This bridge is computed to bear six times more load than any to which it can ever be exposed. The plan of it was only submitted to the Commissioners for the Highland roads and bridges on the 9th of August last; and although the granite of the former bridge was on the ground dressed and prepared, they, without hesitation, agreed to adopt it; but it was near the middle of September before the iron was brought on the ground and the work begun; and yet, though one-third of the time was lost through inclement weather, the bridge was opened for public traffic in the third week of November, which was barely two months of workable time. The whole of the iron-work, about twenty tons, was forged and fitted upon the spot during the progress of the masonry, with the exception of a small portion of metal castings, used in the structure, and the Highlanders in the locality of the bridge, with the exception of three smiths, and a few Aberdeen masons, did the whole of the work; and the bridge was asphalted, painted, gravelled, and completed, at a less cost than that of a rude timber bridge, whose duration would be short under the best of circumstances.—Dredge's Registered Girder for Bridges, next to his Patent Suspension Bridge, attains the *maximum* of strength and stability, with a *minimum* of material.

THE SCREW-STEAMER "BOSPHORUS."—(SEE VOL. LIII., P. 482.)

The General Screw Steam Shipping Company have received a despatch from the Commander of the *Bosphorus*, the first of the line of Cape mail steamers,—dated "Off Madeira, Dec. 24," in which he gives the following account of the performance of Mr. Maudslay's feathering screw:—"The wind continued favouring us till, on Sunday last, at 1 p.m., having fine fresh breeze, and appearance of continuing, we let the fires down and feathered the screw, *which we did with no difficulty*. We ran twenty-four hours without steam, under studding sails and royals, making 215 miles. At 1 p.m., on Monday, we tried the speed of the ship with the screw in steaming position, and afterwards feathered. Rate, 6¼ knots steaming position; 8 knots feathered. Yesterday evening, wind becoming light, at 9h. 30m. got steam up, and the screw was *replaced in steaming position in one minute*. Thus far it has proved quite satisfactory, and with the precaution of not letting the screw go too long without changing its position, lest it should get set fast, I feel it will be a great advantage and no trouble in any way. It drives the ship as fast as the old one, the engine making perhaps two or three revolutions on the average more than with the other."

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JANUARY 9, 1851.

JAMES KINGSFORD, of Essex-street, Strand, esquire. *For improvements in refrigerating and freezing.* Patent dated July 3, 1850.

The principle of the present improvements seems to consist in causing a current of air, in a state of expansion, to be drawn or exhausted through an air-tight case, and to impinge in its passage against the exterior of vessels containing the water, liquid, or substance to be frozen or cooled. The case is provided with partitions extending nearly across it, and the vessels are so placed as, in connection with them, to form a circuitous passage from end to end of the case. The air is thus caused to act equally against each vessel. When the vapour of ether, sulphuret of carbon, or such other volatile spirit is employed in lieu of air, a condenser for reconverting the vapours to their original state is attached to the apparatus.

Claim.—Combining apparatus, as described, for the purposes explained.

FRANCIS EDWARD COLEGRAVE, of Brighton, esquire. *For improvements in the valves of steam and other engines, in causing the driving wheels of locomotive engines to bite the rails, and also in supplying water to steam boilers.* Patent dated July 3, 1850.

I. In working the slide valves of steam-engines, according to the methods at present in use, a large amount of power is expended in overcoming the pressure of the steam at the back, which, in locomotives especially, amounts to as much as 100 lbs. on the square inch. This is a disadvantage which Mr. Colegrave proposes to obviate in the following manner :—On the face of the cylinder, in which are the steam ports, are screwed four studs at a sufficient distance apart, to admit of the free working of the slide-valve in the ordinary method. On the projecting ends of the studs (which are threaded for the purpose) are screwed four nuts, the upper surfaces of which are truly faced and come flush with the back of the valve. A plate of iron with a hole at each corner to admit the studs is then placed over the back of the valve, so as to be supported on the nuts, in which position it is secured by other nuts, but not so tightly as to impede the free action of the valve. The valve will thus traverse backwards and forwards between the face of the cylinder and the fixed plate, which will receive the whole of the back pressure of the steam. The objection, that the valve will wear away by continued working to such an extent as to admit the steam between it and the plate, is met by the proposal to construct the valve with a moveable plate at the back instead of being solid as at present. Coiled or other springs are to be placed underneath the plate in suitable holes in the metal of the valve, by which means constant contact will be maintained between the rubbing surfaces.

The additions above specified may be readily adapted to cylinders now in use; but when new valves are constructed on this principle, it is recommended to have them circular instead of square; and if desirable, a hole may be made in the centre of the valve and fixed plate, so as to exhaust the steam through the back of the valve.

2. Two arrangements are shown for carrying into effect that part of the invention which consists "in causing the driving wheels of locomotive engines to bite the rails." The first of these consists in directing a blast of hot compressed air against the rails immediately in front of the driving wheels, by which, in damp and slippery weather, they will be almost instantaneously dried. According to the second method, the leading, driving, and trailing wheels are geared or connected together by a rope or band, and a sufficient amount of cohesion between the rails and wheels is secured to propel the train.

3. It is proposed to heat the water before its entrance into the boiler, by causing it to pass through water spaces under and around three sides of the ash-pan.

Claims.—1. Constructing the slide valves of steam engines with moveable back plates, which are made to work against a stationary plate, which takes off the pressure of the steam, and prevents it from acting against the back of the valve, as is now almost always the case.

2. The methods shown and described, or any mere modification thereof, for drying the rails and causing the wheels of a locomotive to adhere more firmly thereto in damp and slippery weather.

3. The employment of a water space beneath and around the ash-pan for heating the water, previous to its passage from the tender into the boiler.

CHARLES PHILLIPS, of the city of Bristol, engineer. *For improvements in machinery or apparatus for cutting turnips, and other similar substances as food for cattle.* Patent dated July 3, 1850.

These improvements as claimed, are—

1. The construction of a machine for cutting turnips and other similar substances provided with knives, the cutting edges of which are placed obliquely with respect to the course in which they move. This improvement is based on Gardner's turnip cutter, patented in 1834, in which the knives were placed at right angles to the direction of their revolution.

2. The application of shifting plates to turnip cutters in the manner described for the purpose of reducing the thickness of the slices. In machines of the sort above described, it is preferred to have a separate plate for each required thickness of slice, but in other cases, one plate capable of adjustment by means of screws is found to answer the purpose.

(We give the two following claims verbatim—they are curiosities in their way.)

3. "Believing it to be entirely new, I claim the construction of a machine for cutting turnips in which the hopper has an oscillating motion on the fixed body of the machine."

4. "Should it at any time be discovered that an oscillating motion of the kind described is not new, I claim the oscillation being on a horizontal axis, whereby the turnips in the fixed part of the machine contribute in a great measure to displace those in the moveable hopper."

5. The use of any kind of spring to prevent breakage in the event of an obstruction occurring to the oscillation of the hopper, acting in the same way as the spring described, and which forms part of the con-

nection between the hopper and the crank, by which it is actuated.

WAKEFIELD PIM, of the town or borough of Kingston-upon-Hull, engine and boiler maker. *For certain improvements in the construction of the boiler and funnels of steam engines.* Patent dated July 3, 1850.

In the boiler here specified, the tubes are arranged in two tiers, with a water space between them, the flame and products of combustion passing through both previous to their entrance into the funnel, the position of which is thus necessarily altered.

Claim. — Constructing the boiler and funnels of steam engines, so as to give a double circulation to the flame and heated gases generated in the furnaces of marine steam engines through the tubes as described.

JAMES WARD HOBY, of Blackheath, engineer. *For certain improvements in the construction of parts of the permanent ways of railways, and in shaping iron.* Patent dated July 3, 1850.

The extent of the present improvements will be readily gathered from the claims, which are—

1. A method or methods of securing rails upon longitudinal or transverse bearers or sleepers, by curved or angular lips on one side, and by means of bolts and nuts, or rivets, passing through one of the flanges of each rail, or passing between the edge of the flange and a projecting rib or studs, or by means of a curved or angular dog and bolts and nuts, or rivets on the other side of the rail, as described.

2. A mode or modes of securing and holding rails upon longitudinal or transverse bearers or sleepers, by means of curved or angular lips on one side, and by means of ribs or studs and keys on the other side, as described.

3. The application of chocks along each or either side of a line of rails, either with or without keys, for the purpose of securing such rails upon longitudinal or transverse bearers or sleepers, in the manner described.

4. A mode or modes of constructing the troughs of longitudinal iron trough-sleepers or bearers, for holding and securing rails, so that one side or shoulder of each trough shall fit to and support one side of the rail placed within it, and also so that a key or keys may be introduced within the trough on the other side of the rail, for the purpose of supporting it, in the manner described.

5. A mode or modes of constructing longitudinal bearers so that a shoulder or side of each such bearer, shall fit to and support one side of each of the rails placed upon it, the other side of each such rail being supported by means of chocks, with or without the assistance of keys, or by means of a rib, or studs and keys, as described.

6. A mode or modes of constructing stretchers of tubular or hollow iron, and also the combination of such stretchers with transverse tie-rods, as described.

7. A method of constructing railway keys of various bent, curved, and similar forms, and also of constructing railway keys of metallic tubing filled with wood, as described.

8. The application of a combination of rollers, or of a die or dies and a roller or rollers, with or without the aid of a mandril, in conjunction with a draw-bench or other similar apparatus for shaping and forming strips or pieces of sheet iron, in manner described.

WESTON TUXFORD, of Boston. *For improvements in machinery for crushing or pressing land, and for shaking straw; also improvements in applying steam power to agricultural machinery.* Patent dated July 4, 1850.

Claims 1. Constructing rollers for pressing and crushing land, as described. [Another addition to the already numerous list of clod-crushers.]

2. A method of working machinery for shaking straw, to separate the grain therefrom.

3. Arranging the engines of portable steam engines, within houses or closed compartments, by which means the power thereof may be applied to machinery for agricultural purposes, under more favourable circumstances than at present.

RICHARD HORNSBY, of Spittlegate, Lincoln, agricultural implement manufacturer. *For improvements in machinery for sowing corn and seeds, and in depositing manure, in thrashing machines, in machines for depositing or winnowing corn, and in steam engines and boilers for agricultural purposes.* Patent dated July 3, 1850.

The improvements in sowing machinery comprehend, 1. A method of supporting the seed-box on a pivot or axis, at or near the middle of its length, so as to render it capable of maintaining a constantly level position, in spite of the inequalities of the ground over which the machine may be travelling. 2. A method of working the axis of the seed-barrel, so as not to interfere with the seed-box as thus supported, and to admit of its adjusting itself. 3. The substitution of flexible tubes of India rubber or gutta percha, with or without an internal coil of wire for the metal cups ordinarily employed. 4. and 5. Improved

methods of steering the fore-carriage and coulters. 6. Making the coulter levers of malleable cast iron.

Under that head of the specification relating to seed and manure depositing machines, the patentee describes, 1. The application of the principal improvements previously specified. 2. The application to ridge drills, of rollers, composed of two parts, so as to be capable of being reduced or increased in size at pleasure. 3. The application of narrow rollers for crushing and pulverizing the soil at the bottom of the furrows. 4. The application of small harrows or instruments with lines or teeth, for the same purpose.

The improvements in threshing machines are, 1. Making the drum of a series of cones, fixed to an axis, and provided with radial projections, and the concave with corresponding spaces also provided with similar projections. 2. The application to the screen of fixed inclined bars, by which the straw is raised from and allowed to fall back on the wire of the screen. 3. The employment of an inclined receiver for the grain.

With relation to dressing and winnowing machines, the improvement consists of a method of regulating the distance between the feed-roller and the shoe or hopper (by raising and lowering the former), during the operation of the machine, without danger to the operative.

The improvements "in steam engines and boilers for agricultural purposes" consist in placing the cylinder inside the boiler, or in a steam chest on the smoke-box; in arranging the pump at the bottom of the chimney, or at the top of the smoke-box; and in the application of a metal casing, pierced with numerous holes, to the whole length of the fire-box, for the purpose of introducing air from the ash-pit, to promote combustion.

Claims.—1. The improvements in machines for sowing seeds and depositing manure. 2. In thrashing machines. 3. In dressing and winnowing machines. And, 4. In portable steam engines for agricultural purposes, as described.

John Coope Haddan, of Bloomsbury-square, Middlesex, civil engineer. *For improvements in the construction of carriages and of wheels, and in brickwork.* Patent dated July 3, 1850.

The improvements in carriages are threefold, and consist—

1. Of constructing the sides and end-pieces of the under framing of railway carriages with bars or plates, the ends of which are bent, so that when placed together the bendings may lap round each other, and be connected so that the corners of the carriage shall be double, or of two thicknesses of metal; and also in constructing the transverse and diagonal ties of such under framing with bars bent so as to hold the ends and sides together.

2. In constructing the framing of the sides and ends of railway carriages with diagonal bracings, or struts cut flush with the other timbers of the framing.

3. In placing the external covering of the sides and ends of the bodies of railway carriages against or upon the framing, the parts of which are made flush with each other, to admit of the external covering being thus placed and secured.

The improvements in wheels are thirteen in number, and are principally based on previously patented constructions.

The improvements in "brick-work" consist, 1. Of making the bricks of a rhomboidal form. And, 2. Of building them so that the bricks of each alternate course shall be laid in opposite directions.

No claims.

William Lancaster, of New Bond-street, Middlesex, gun-maker. *For improvements in the manufacture of firearms and cannon, and of percussion tubes.* Patent dated July 3, 1850.—No claim.

Matthew Gray, of Morris-place, Glasgow, practical engineer. *For an improved method of supplying steam boilers with water.* Patent dated July 31, 1850.

Mr. Gray describes three arrangements of apparatus calculated to effect this object. The first of these can be employed only in conjunction with a steam engine or other prime mover; the others are self-acting.

Claims.—1. The three arrangements of apparatus, as shown and described.

2. The application and use of a moveable bucket or vessel, alternately receiving and discharging water, in the manner described, for the purpose of opening and shutting taps or valves by a lever, or other mechanical contrivance, and thereby effecting and regulating the supply of water to a steam boiler.

3. The application and use of a separate fixed or stationary vessel or condenser, connected with a steam boiler or boilers, into which condenser water and steam are from time to time admitted (according as the water in such boiler rises above or falls below a certain desired level or water line), for the purpose of effecting and regulating, by means of valves or taps, with or without the aid of engine or other motive power, the necessary supply of water to such a boiler or boilers.

Specification Due, but not Enrolled.

RICHARD WINTER, of New Cross, Kent, gentleman. *For improvements in metallic vessels for measuring and holding fluids.* Patent dated July 3, 1850.

WEEKLY LIST OF NEW ENGLISH PATENTS.

John Tatham and David Cheetham, of Rochdale, Lancaster, machine makers, for certain improvements in steam engines, in apparatus for generating and indicating the pressure of steam, and for filtering water to be applied to boilers; also improvements applicable to steam vessels or ships. January 2; six months.

Joshua Horton, of Ætna Works, Smethwick, Stafford, steam-engine, boiler, and gasholder manufacturer, trading under the firm or style of "Joshua and William Horton," for improvements in the construction of gasholders. January 2; six months.

John Corry, of Belfast, Ireland, damask manufacturer, for improvements in machinery or apparatus for weaving figured fabrics, which machinery or apparatus is also applicable to other purposes for which Jacquard apparatus is or may be employed. January 2; six months.

Benjamin Cook, of Birmingham, manufacturer, for a certain improvement, or certain improvements in the manufacture of metallic tubes. January 3; six months.

John Percy, of Birmingham, doctor of medicine, and Henry Wiggin, of the same place, manufacturer, for a new metallic alloy, or new metallic alloys. January 3; six months.

Thomas Lawes, of 32, City-road, Middlesex, for improvements in generating and applying steam for certain purposes. January 4; six months.

John Harcourt Brown, of Fir-cottage, Putney, Surrey, gentleman, for certain improvements in the manufacture of wafers. January 7; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 2	2612	George Holcroft	Manchester	Steam boiler.
,,	2613	George Holcroft	Manchester	Steam boiler.
3	2614	William H. Hopkins	Bix, Oxford	Bix-Hill-Side plough.
,,	2615	John Cresswell	Birmingham	Door fitting.
,,	2616	Henry Weatherley	Theobald's-road	Machine for cleaning currants.
4	2617	Louis Braun	Wood-street, Cheapside	Cap.
6	2618	John H. Quincey	Hatton Garden	Parts of a coal-box.
,,	2619	Amedée Devy	Grosvenor-street, Bond-street	Parts of stays.
7	2620	Gaspar Bauchini	Broadwall, Blackfriars	Window-cleaning guard.
,,	2621	Peter Rigby	Liverpool	Spirit bottle.
,,	2622	John Cresswell	Birmingham	Ventilating mattress or cushion.
,,	2623	John Capper and Son	Gracechurch street	Towelling.

CONTENTS OF THIS NUMBER.

Specification of Messrs. Randell and Saunders's Patent Stone-Sawing Machinery—(*with engravings*) 21
On Industrial Education. By "M. S. B." 23
On Impossible Equations. By Robert Harley, Esq 28
The Reform of the Patent Laws 29
Note on the Operation of the New System of Provisional Registration 31
The Flax Cotton.—Progress of Experiments 32
Remarks on Dr. Haycraft's Essay on Anhydrous Steam. By Mr. James Frost 32
Death and Memoir of Professor Davies 33
Victoria Bridge, on Mr. Dredge's Principle 35
The Screw Steamer "Bosphorus" 36
Specifications of English Patents Enrolled during the Week:—
Kingsford .... Freezing 36
Colegrave .... Improvements in Valves 36
Phillips .... Turnip Cutter 37
Pim .... Steam Engines 38
Hoby .... Railways 38
Tuxford .... Crushers 38
Hornsby .... Sowing Machines 38
Haddan .... Carriages, &c. 39
Lancaster .... Fire-arms 39
Gray .... Supplying boilers with water 39
Specification Due, but not Enrolled:—
Winter .... Metallic Vessels 40
Weekly List of New English Patents 40
Weekly List of Designs for Articles of Utility Registered 40

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MR. THOMSON'S PATENT CASE WATER-WHEEL.

Fig. 1.

Fig. 2.

MR. THOMSON'S PATENT CASE WATER-WHEEL.

[Patent dated July 3, 1850. Specification Enrolled, January 3, 1851.]

Specification.

FIRSTLY, my invention consists of an apparatus for obtaining motive power from water, which, as a whole, I call a Case Wheel. Of this there are two varieties, in one of which the vanes are straight, and in the other curved.

Figs. 1, 2, and 3, are respectively a vertical section, a plan, and an elevation of the apparatus in which the vanes are straight, and figs. 4 and 5 are respectively a vertical section and a plan of that in which they are curved. In several of the figures portions of the apparatus are supposed to be broken away, so that other parts may be seen. A is a moveable wheel, which, when it has to be distinguished from the whole apparatus, may be called *the moveable wheel*. It revolves within a fixed case B, the joints F, figs. 1 and 4, between the case and the wheel being made nearly watertight by any of the known methods of making joints which nearly prevent the escape of water, and yet involve little or no friction. I prefer having the meeting parts made to fit very truly to one another without touching, so that there may be no rubbing at all. One method of effecting this is represented in fig. 1, which will be readily understood from inspection; and another, in fig. 4, *r*, *r*, in the latter, representing two rings, which fit tightly to the case, and are capable of being adjusted (by means of nuts and spiral springs, as shown in the engraving, or in any other convenient way) so as almost to touch the moveable wheel. The moveable wheel is attached to a vertical shaft C, which turns at its lower end on the pivot D, fig. 1, and is supported at its upper end by a bearing K, fixed to the cover of the case by a bracket L. The wheel works under the lower water-level W, as represented in figs. 1 and 4, and on this account, at or near the centre of the pivot, there is a hole, by means of which, and a pipe connected with it, oil may be supplied to the rubbing surface. The moveable wheel consists principally of a top and bottom plate *m*, *m*, figs. 1 and 4, and of a number of vanes, or diaphragms *v* inserted in the space between the top and bottom plates, so as to form many radiating passages. Through these radiating passages, the water (having been introduced into the case B, as afterwards explained,) moves from the circumference to the centre of the wheel, where it is discharged by orifices in the top and bottom plates. The parts of the wheel marked *s*, represent a disc and boss, by means of which the vanes are rigidly connected with the vertical shaft, C. When the vanes are curved (as well as when they are straight) I make the outer extremity of each to lie in the direction of the radius passing through that extremity, although it might be made to deviate considerably from that direction (but not so much as to become nearly tangential), without materially altering the peculiar character of the wheel, or, in other words, without altering in any material degree the velocities which the wheel and the water should have, and on which the peculiar character of the wheel mainly depends. Also, when the vanes are curved their inner ends should be turned backwards, as shown in fig. 5 (and as will be hereafter more fully explained) in such a degree that when the proper average quantity of water is flowing through the orifices *o*, *o*, thus formed, it may be sent backwards from these orifices with nearly the same velocity as that with which they are moving forwards, so that in reality the water on leaving the vanes may have little or no velocity of rotation, but only a motion towards the axis of the wheel.

It is well to make some of the vanes, as shown in the engravings, stop short without approaching so near to the centre as the rest, especially if they be not made of very thin metal. The reason for making them thus is to prevent them from occupying too much space, and impeding the flow of the water. The dotted lines in fig. 1 represent the terminations of two vanes, which are shorter than the one in front of them both.

Before reaching the radiating passages between the vanes, the water coming from the upper reservoir flows into the case by one or more entrance orifices, E, fig. 2, E, E, fig, 5. I do not limit myself to any particular number of such orifices in either variety of the wheel, though I consider that one will be enough when the vanes are straight, and two or four when they are curved. Each of the nozzles Z, Z, terminating at one end in the entrance orifice, and at the other in the supply-

Fig. 10.

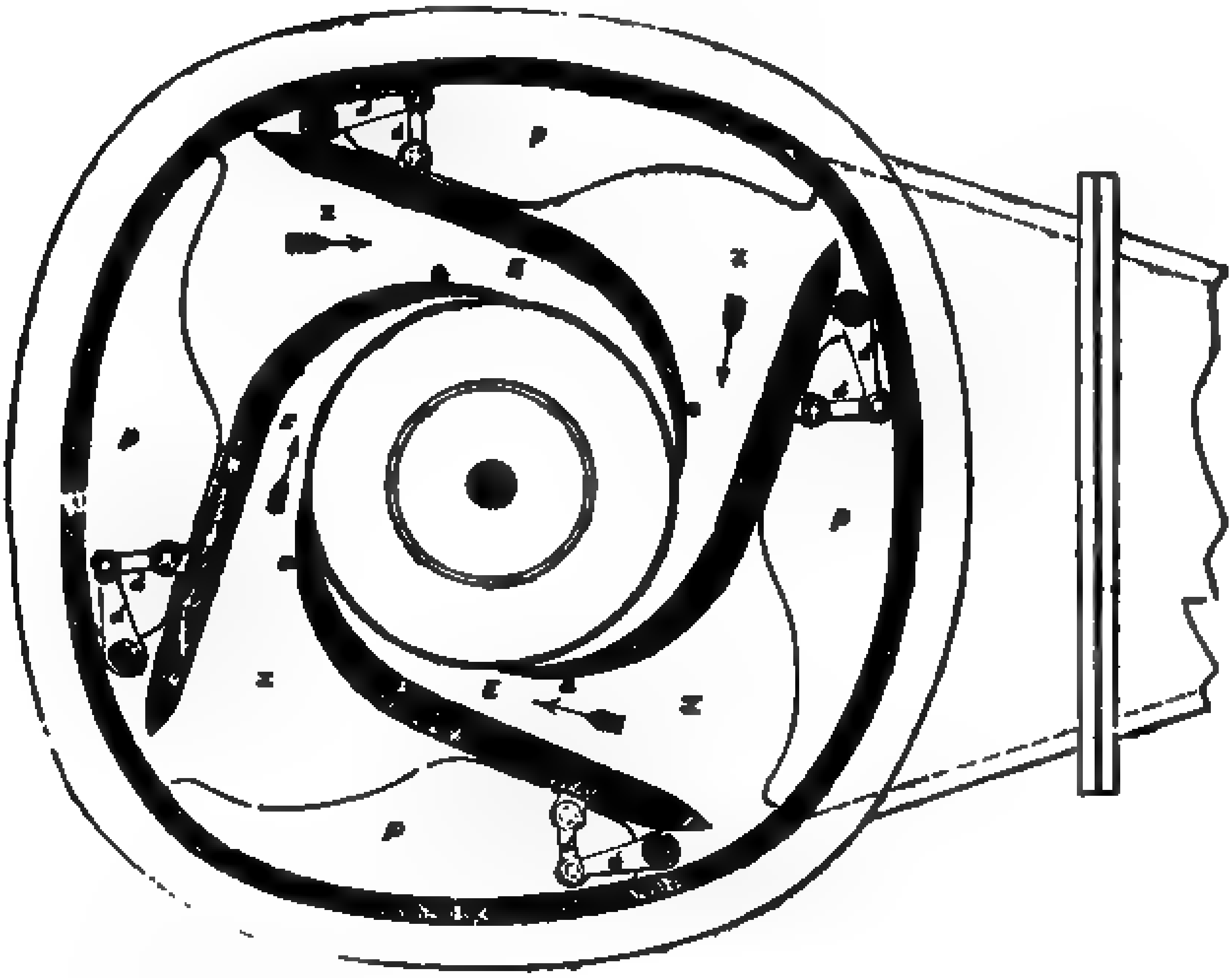


Fig. 11.

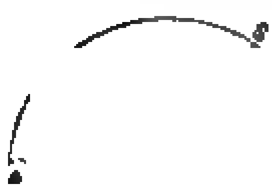


Fig. 9.

Fig. 4.

pipe, increases gradually in area from the orifice towards the supply-pipe, as shown in the engravings, its form being made such as may be supposed would allow the water to attain its velocity with the least possible resistance. After flowing into the case, the water passes along the inside of its circumference, which is made of a spiral, or spiral-like form, so that the water, as it revolves, may be uniformly impelled towards the centre. The water is thus made to enter the radiating passages in the wheel; and because it has very nearly the same motion, both in regard to direction and velocity, as the circumference of the wheel, there is little or no loss of mechanical effect from impact between the water and the wheel. The centrifugal force tends to prevent the water in the wheel from moving towards the centre, but the water is constantly urged in that direction in relation to the wheel, by the new supplies of water, which are continually entering at the circumference of the case. In consequence of the combined motion of the wheel and water, each particle of water moves in relation to the case along a certain continuous spiral course from the entrance to the exit orifice. The spaces within the case above and below the wheel contain water which has a considerable rotary motion, but no motion towards the centre, except what is necessary to supply water for the slight leakage which takes place at the joints F, F, between the case and the wheel. The centrifugal force of the water in these spaces has the good effect of making the pressure inside of the case at the joints less than it would otherwise be, and of thus diminishing the leakage.

Fig. 5.

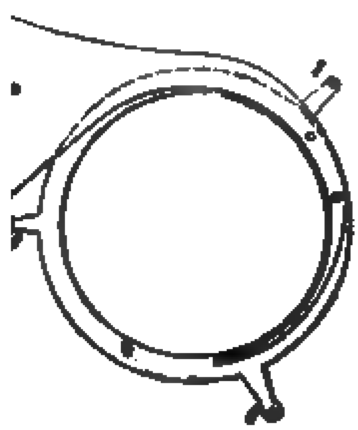


Fig. 6.

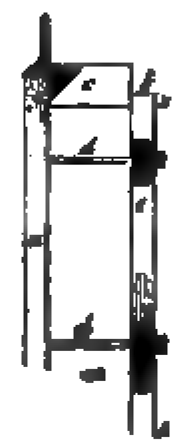


Fig. 7.

The principal conditions to be fulfilled as nearly as may be in practice in the action of this mechanism, are that the water should enter the wheel without impact, should pass through it without resistance, and should leave it without velocity. Hence the entrance orifices are made of such magnitude that when all the water which is intended to supply the wheel is flowing through them, its velocity may be very nearly that due to half the head (or height of fall). Then, since, as was before stated, the circumference of the wheel moves at very nearly the same rate as the water, it can be demonstrated that, in the case of straight vanes, the centrifugal force of the water in the wheel must maintain a pressure at the circumference, which very nearly balances the other half of the head, and that, in the case of curved vanes, the same pressure at the circumference will be maintained by the centrifugal force and the contraction of the inner ends of the passages in the wheel produced by the curvature of the vanes. When the vanes are straight, I make the diameter of the wheel several times (usually about three and a half times) as large as that of the central orifices, or eduction passages. Then, as each portion of the water moves towards the centre of the wheel, it comes successively in contact with parts of the vanes, each of which has less velocity than the part immediately preceding. Thus the rotary velocity of the water is gradually diminished, till by the time the water reaches the central orifices, the mechanical effect belonging to its rotary velocity is almost nothing. When the vanes are curved, I do not usually make the diameter of the wheel more than double that of the central orifices. In this case the

water is deprived of its rotary velocity, partly in the same way as in the other case, and partly by its being sent backwards from the inner extremities of the vanes. The quantity of water admitted to the wheel may be regulated in various ways, so that it may be just sufficient to do the work required at any particular time. If the amount of power required be not subject to much variation, and if a moderate variation in the speed of the wheel be allowable, it may be unnecessary to have any peculiar regulator, since the wheel is capable of regulating the supply in a considerable degree for itself. Thus, if the work to be performed be diminished while the wheel is in action, the speed of the wheel increases slightly, and therefore the centrifugal force of the water in the wheel increases, and produces an increased pressure inside of the case at the circumference, which diminishes the quantity of water admitted by the entrance orifice or orifices. On the other hand, if the work required be increased, the speed of the wheel, and consequently the centrifugal force, diminishes, and the quantity of water increases. Again; if the water be not very valuable, the supply of the water and the speed of the wheel may be regulated by a simple sluice, or by a throttle valve. This method, however, is not good in cases in which it is of importance that the water should be economized to the utmost. In such cases, I prefer the employment of mechanism such as is represented in figs. 4, 5, 6, 7, and 8, or such as in figs. 9 and 10. In figs. 4, 5, 6, 7, and 8, the case is supposed to have two entrance orifices E, E. Should there be only one, or should there be more than two, a mechanism of exactly a similar character, but adapted to the number of orifices, would be used. The principal part of this regulator consists of two sluices *a*, *a*, adapted one to each orifice. One only of these is represented in figs. 6, 7, and 8, the other being supposed to be removed. They occupy part of the space within the case outside of the circumference of the wheel, and are capable of being lowered to the bottom of the recesses *b*, *b*, fig. 4, or raised almost entirely out thereof. The sluices should be made to fit pretty closely to the vertical sides of the recesses at all parts, but more especially at the parts outside of the entrance orifices, as any opening there through which water could leak would be injurious. To prevent water from passing below the sluices through the entrance orifices, a vertical plate *c* is attached to each sluice. These plates pass through slits in the bottoms of the recesses *b*, *b*, and they should fit as well as may be to the vertical sides of the recesses, and to the slits. By means of these plates, and of spindles *d*, *d*, the sluices are connected to a ring *e*, which can be raised or lowered in any convenient way, as, for instance, by three vertical rods attached to it at the ears *f*, and hanging by means of screws at their upper ends, which screws, being connected by toothed wheels, revolve all at the same rate, so that all parts of the ring may be equally raised or lowered at pleasure. It may be advantageous to have packing-boxes attached to the bottom of the case, as shown in fig. 4, to prevent leakage round the vertical plates and spindles just mentioned. In figs. 9 and 10 there are supposed to be four entrance orifices marked E, the areas of which can be altered at pleasure by moving the pieces marked *b* round vertical axes determined by pivots or hinges marked *a*. These moveable pieces are the lateral boundaries of the nozzles marked Z in this figure as in the preceding ones, and the inside of each of them facing the wheel forms the spiral which guides the water uniformly towards the centre. The water ascends through four openings P before entering the nozzles. The apparatus marked *d* is for giving the requisite motion to the pieces marked *b*. The explanations and principles already given in reference to the case wheel will render the meaning of figs. 9 and 10 sufficiently clear when it is observed that the arrows on these figures indicate the principal motions of the water.

According to the best calculations I have been able to make as to the principal dimensions of the wheel and case, and the velocity of the wheel, these should be as follows:—

Let Q be the quantity of water in cubic feet per minute, and H the height of fall in feet.

Then, Total area of entrance orifice or orifices

$$= \cdot 00329 \frac{Q}{\sqrt{H}} \text{ square feet.}$$

Diameter of each central orifice of the moveable wheel

$$=\cdot 0915 \sqrt{\frac{Q}{\sqrt{H}}} \text{ feet.}$$

Diameter of the wheel, if the vanes be straight $=3\cdot 5$ times the diameter of each central orifice of the wheel.

Diameter of the wheel, if the vanes be curved = twice the diameter of each central orifice of the wheel.

Revolutions per minute if the vanes be straight

$$=316 \sqrt{\frac{H \sqrt{H}}{Q}}.$$

Revolutions per minute if the vanes be curved

$$=553 \sqrt{\frac{H \sqrt{H}}{Q}}.$$

Again; to determine the angle which the inner end of each vane should make with the radius passing through it:—

Let c = circumference of each central orifice in feet;

d = distance in feet between the top and the bottom plate of the wheel, minus the thickness of the plate for attaching the vanes to the shaft;

t = thickness of each vane in feet (or fractions of a foot);

n = number of vanes which terminate at the circumference of the central orifice;

v = velocity of the inner end of each vane in feet per minute.

Also let C, fig. 11, be the centre of the wheel; D S G part of its outer circumference; N F B part of the circumference of one of its central orifices; and let F be the termination of one vane, and K that of the next which reaches to the circumference of the central orifices.

Make T H perpendicular to F C, and such that

$$FT : TH :: \frac{Q}{cd} : v.$$

Then F H would be the direction of the inner end of the vane passing through F, if the vanes were infinitely thin. To correct for the thickness make

$$FT : FO :: \frac{Q}{cd} : \frac{Q}{cd - \frac{ntd}{\cos HFT}}.$$

Draw O P equal and parallel to T H. F P is the true direction of the end of the vane.

Again; draw F L perpendicular to F P, and a little longer than F C. It may be about $=1\cdot 2$ FC. From L, as centre, describe an arc of a circle F R, terminating at R in the continuation of C K. F R is the inner portion of the vane, and in forming the remaining portion, all that need be attended to, is to give it a gentle curvature, and to make a short portion of it at S be in the direction of a radius passing through S.

[Mr. Thomson describes also another variety of wheel, which he calls a Suction Wheel, and some Steam Engine improvements. We shall give these in our next. For his Claims, see afterwards, p. 57.]

ANHYDROUS STEAM.—DR. HAYCRAFT, IN REPLY TO MR. FROST.

Sir,—I would beg the favour of inserting in your valuable periodical a very few remarks in reply to Mr. Frost's letter, p. 32.

What has made Mr. Frost so displeased with me I am at a loss to conceive, as his views and mine coincide in a very remarkable manner, unless it be this very coincidence which may be too great for his purposes. It would appear that he has even seen proper to leave his courtesy on this side the Atlantic by his manner of treating the subject.

Mr. Frost objects to my term, "Anhy-

drous Steam," because, as he says, "steam is a compound of water and caloric." This criticism merely shows the slight attention he has paid to the principles of chemical nomenclature. Anhydrous simply means free from water; and anhydrous steam is merely dry steam; and I believe all practical men can distinguish between dry and wet steam. On the same principle Mr. Frost would object to the term of dry or anhydrous sugar, because sugar is a compound of water and charcoal; yet sugar is no more water than steam is water, and each is capable of combination with a quantity of water—not essential to their own composition.

The form of the instrument I experimented with, is likewise objected to, but without any reason assigned, unless it be that Mr. Frost supposes that he "could not have practically experimented with such an ill-contrived instrument; for when immersed in heated oil, he possessed no other means of observing the volume of steam therein than by withdrawing the instrument from the oil, when the cold air would instantly condense the 'stame' to steam; for I have constantly observed denuding the smallest portion of an instrument in contact with 'stame' destroys an experiment." To all this I would reply that the difficulty Mr. Frost dreams of is entirely obviated by using a glass vessel for containing the oil bath, by which means the slightest effect produced by increased temperature on the steam, can be most accurately observed. Added to this the whole of the apparatus is completely immersed in the heating medium, so that no source of fallacy can possibly exist by any part of the instrument being denuded. This can, I think, hardly apply to Mr. Frost's instruments. These besides have so many turns and twists in them, that should there be any atmospheric air contained in them it would be difficult to get rid of it, and the presence of air would infallibly spoil the experiment. In my simple apparatus I found it necessary to expel a very small portion of air, which had it been neglected the result would doubtless have been analogous to Mr. Frost's.

Mr. Frost has some most singular ideas. In his last letter, he says, "In fact, in No. 3, the steam was confined by only 21 lbs. per inch, while the expansive force thereof exceeded 2,000 lbs. per inch." If I were disposed to be rude and discourteous, I should say, with Mr. Frost, this is absurd; but I will merely say that it is unintelligible. How a resistance of 21 lbs. can restrain a force of 2,000 lbs. is perfectly astonishing; I would, however, suppose that Mr. Frost means to say that the resistance of 21 lbs. was able to restrain steam which, if not suffered to expand, would hypothetically have acquired a force of 2,000 lbs.

But my time is too valuable to waste in verbal criticisms, and in refuting misconceptions. It would be for me a much more pleasing task to be the means, in concert with Mr. Frost, of throwing some light upon a difficult and most important subject. I have given, and do give, Mr. Frost full credit for the originality and general soundness of his views, although, in one point, I think he is mistaken. In the main facts we agree; viz., that an immense economy may be effected in the steam engine, and that its general utility and safety may be materially increased. This I hope to be able to demonstrate shortly—probably at the ensuing Exhibition. By a simple contrivance, and by merely turning a superheating cock, it may be possible to demonstrate in the course of a minute the superior action of anhydrous steam, and in an apparatus not subject to injury by heat, as Mr. Frost erroneously supposes.

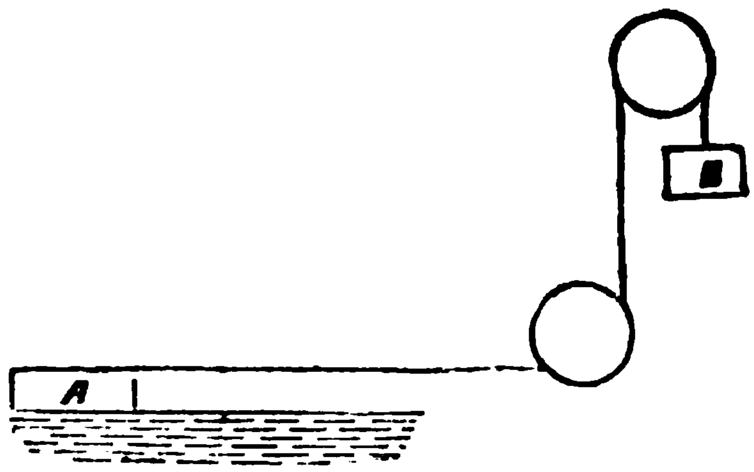
I am, Sir, yours, &c.,
W. Haycraft, M.D.

Greenwich, Jan. 13, 1851.

LAW OF RESISTANCE TO THE PASSAGE OF BODIES THROUGH WATER.—ANSWER TO THE QUERY OF "A. B. C."—(LAST VOL., P. 509.)

To propel a vessel at a certain speed, a certain quantity of water has to be disturbed, and if we call this supposed speed 1, and the supposed quantity of water disturbed likewise 1, then the resistance will be represented by $1 \times 1 = 1$; but if we double the speed, double the quantity of water will have to be displaced at double the velocity, or $2 \times 2 = 4$. Thus we see that the resistance is as the squares of the velocity—this being granted, it may easily be shown that the power required to propel a boat is as the cubes of the velocity.

In the following diagram, let A represent a boat, and B a weight over a pulley. Then the weight required to pro-



duce different speeds will represent the resistance and the velocity with which B descends multiplied into its weight will represent the power. Let us, in the first place, call the speed 1, and the weight necessary to produce that speed likewise 1; of course the weight will descend with a velocity equal to 1, and the velocity multiplied into the weight or $1 \times 1 = 1$ of power, whereas if we double the speed, four times the weight will be required, and, of course, B will be equal to four, and will fall at a velocity equal to 2, or the velocity × weight $= 2 \times 4 = 8$ of power, which is as the cubes of the speeds.

J. B. G.

January 30, 1850.

Another Solution.

A correspondent, "A. B. C.," inquiring why in a body moving through water, the velocity was said to be as the cube root of the power, he being at the same time aware that the velocity was only as the square root of the resistance, and consequently of the force or pressure required to propel the body.

In order to understand this apparent paradox, he must make a distinction between pressure and power. Take for instance a horse hauling a boat along a canal. The force or pressure is the strain the horse exerts on the towing rope—the power is this force multiplied by the distance over which the horse travels. It is evident from this definition that if the speed of the horse is increased, the power is increased in any given time in the same ratio, independent altogether of any increase in the strain on the rope. But, by increasing the speed, the strain is also increased as the square of the velocity. Now, the power being the product of the distance passed over and the force exerted, the former varying as the velocity, the latter as the square, the power must necessarily vary as the cube of the velocity.

It must be kept in mind, however, that the power varies in this ratio only for equal intervals of time. It varies as the square of the velocity for equal distances passed over.

For example, if the ocean steamers could double their speed, so as to cross the Atlantic in five days instead of ten, as at present, they would encounter four times the resistance, and expend only four times the power in overcoming it during the voyage; but this quadruple power would be expended in half the time, and of course eight times the quantity required at present in any given time. The engines would then require four times as much fuel during the entire voyage, and eight times as much per day.

S. G. S.

Edinburgh, January 8, 1851.

NEW TABLE OF THE VALUES OF SURVIVORSHIP ASSURANCES. BY "I. B. B."

Sir,—Having to acknowledge the favourable reception of some former communications in your excellent Miscellany, I am now induced to forward a Table of Values, which will be found of an important practical nature; it is selected from a collection for intended publication. For the computation of survivorship assurances, the formulæ of Morgan, Baily, Milne, and others, are well known in their application to the case of any given life failing before or after another; and, being all derived from the same general principle, they differ only in form of expression. The investigations of Mr. Morgan were originally published in the "Philosophical Transactions;" and those who have perused them, will be familiar with his remarks on the modification of the chance of survivorship in the case of equal ages, or of ($\frac{1}{2}$) for that of all ages, and either of two lives dying first or last; and the effect of which, he inferred, was to correct the error in the resultant series of value from the assumption of ($\frac{1}{2}$) universally. But with this source of defect there is a further one, as it seems in the contingency resolved that any given life shall fail the first in order;

for it is strictly not on both lives to fail in any year that the claim depends, but when the joint lives fail, that it shall be the specified life in particular, and which finally determines the same, independent then of any effect as to the other life: and it is by a correction of the given chances in the problem that a formulæ arises by which the subjoined Table of Values has been deduced; but the investigation thereof must necessarily for the present be reserved. It is remarkable, too, that the acute, observing Simpson did not perceive the extreme defectiveness of his solution, considered theoretically, apart from any practical test, and that a writer who, unaided by any but the resources of his own mind, should investigate, and with precision, the equations to the lunar theory contemporaneously with Clariut, Euler, &c., should, in a truly interesting, but less abstruse doctrine, be satisfied with such a rule of deduction. For there is nothing of a theorem, perhaps, so imperfect throughout the entire portion of his original disquisitions and writings; but as if in honour to the inventive genius of the man, the rule under comment is even still retained by some of the old offices as to the rates of assurance, on the contingency of which it is grounded; and otherwise viewed, a perverse adherence to it is extraordinary and indefensible,—more obviously than has been argued of De Moivre's Hypothesis and Rules.

I am, Sir, yours, &c.,

I. B. B.

Oct. 30, 1850.

SPECIMEN TABLE.

Showing the true values of the assurance of 1*l*. on the contingency of A, failing the first of two Joint Lives, AB; at 3 per cent., according to the law of mortality at Northampton.

A.	B.		A.	B.		A.	B.		A.	B.	
10	15	,231412	20	60	,137628	35	65	,167142	55	75	,203760
	20	,215466		65	,115700		70	,136202			
	25	,203993		70	,093303		75	,106864	60	65	,348392
	30	.191570								70	,297820
	35	,177881	25	30	,276310	40	45	,306741		75	,243527
	40	,162854		35	,259947		50	,281251			
	45	,147376		40	.241159		55	,254432	65	70	,353856
	50	,131080		45	,221099		60	.224863		75	,294890
	55	,115195		50	.199166		65	,192497		80	,234527
				55	,177150		70	,157763		85	,181016
15	20	,246634		60	,154053		75	,124382			
	25	,234470		65	,129908						
	30	,221123		70	,105043	45	50	,317133	70	75	,361852
	35	,206224					55	,289250		80	,294930
	40	,189642	30	35	,285590		60	,257692		85	,231929
	45	,172380		40	,266285		65	,222297			
	50	,153991		45	.245345		70	,183472	75	80	,369976
	55	,135904		50	,222073		75	,145528		85	,298512
	60	,117317		55	,198418						
	65	,098244		60	,173281						
				65	,146681	50	55	,325682			
				70	,119010		60	,293048			
20	25	,266907					65	,255241			
	30	,252800					70	.212545			
	35	,236816	35	40	,295163		75	,169900			
	40	218760		45	.273565						
	45	.199730		50	,249068	55	60	,340160			
	50	.179201		55	.223782		65	,299852			
	55	,158803		60	,196472		70	,252490			

This is the first instance of these values being found differently from the received analysis of the contingency in the problem; and however critically reviewed, this is not an occasion to pursue the subject to a demonstration.

It will be in the recollection of our readers, that the late lamented Charles Holtzapffel had at his death, arrived at the end of the second volume only, of the great work by which he has given to his name an imperishable place in the history of mechanics; but that he left behind him a considerable portion of a third, written, though not published, and also a large collection of notes and materials, for the remaining volumes required to complete his original plan. We have now before us the third volume, which he left in an unfinished state; and are well pleased to see from it that the author's papers have been placed in the hands of a gentleman fully competent, not only to turn them to their intended account, but to supply from his own resources whatever was left wanting. We cannot praise it more highly, than by saying that it fully sustains the character which the work has acquired, of being the most original and practically useful work on the mechanical arts which has appeared in England during the past century. The following are not among the best specimens which might be selected, but we prefer them for exemplification because they can be detached, with but slight injury to the sense, from the engravings with which the volume is, like the preceding ones, very profusely illustrated.

Marbles for Children.

These are principally manufactured in Germany; some are made of clay, covered with a glaze, and baked as in pottery; others are made of alabaster and marble; but the greater part are made of a hard stone found near Coburg, in Saxony. The stone is first broken with the hammer into small cubical fragments, and about 100 to 150 of these are ground at one time in a mill somewhat like a flour mill. The lower stone, and which remains at rest, has several concentric circular grooves or furrows; the upper stone is of the same diameter as the lower, and is made to revolve by water or other power. Minute streams of water are directed into the furrows of the lower stone. The pressure of the runner on the little pieces rolls them over in all directions, and in about one-quarter of an hour, the whole of the rough fragments are reduced into nearly accurate spheres. Frequently a thick circular slab of oak or elm is used instead of the upper or revolving stone.

Fictitious Gems.

Fictitious gems are prepared in a variety of ingenious methods; sometimes stones of inferior value are modified in their colours by heat, and substituted for more valuable gems, as in the case of the zircon, which is sometimes rendered colourless by heat, and substituted for the diamond. The colours of carnelian are principally given by heat. In "Phillip's Mineralogy," it is stated that carnelians, when found, are of a blackish olive, passing into a grey. "These are first exposed to the sun for some weeks, and then placed in earthen pots and subjected to heat, which gives them the colours which constitute their value in jewellery."

Carnelian, when imported into England, is generally of a red colour; and when the colour is too light, it is sometimes deepened by putting it in an iron pot, and gradually bringing it to a red heat. Yellow carnelian is by the same means rendered red; but the effect of heat upon white carnelian is to render it more opaque, and advantage is sometimes taken of this circumstance to give white carnelian the appearance of white onyx. The various colours of agates are in some cases more fully developed in the same manner; at other times the agates are soaked in oil for two or three hours; the oil penetrates the agate, and is afterwards carbonized within the stone by exposing the latter to the fumes of heated sulphuric acid. Nitrate of silver is also sometimes employed for staining agate and other stones.

Pastes are, however, the most frequent substitutes for precious stones. The foundation of all pastes is a superior colourless glass, called strass, made from very pure materials, and afterwards coloured by the addition of metallic oxides, in much the same manner that ordinary coloured glass is made, except that the process is more carefully performed throughout. The French are considered to excel in the preparation of pastes; and a variety of recipes for the manufacture of pastes, derived from various French authors, are given in Dr. Ure's "Dictionary of Arts," p. 943; and also in Gill's "Technical Repertory," vol. ii., p. 308.

Metallic foils, made of thin sheet copper, silvered and burnished, and afterwards coated with transparent colours mixed with isinglass size, are often employed by jewellers to improve the brilliancy of pastes and in-

ferior stones. The foil is enclosed in the setting, and entirely covers the back of the stone, to which it imparts much of its own brilliancy. When it is desired to modify the colour of the stone, a foil of lighter or darker tint is used, according to circumstances. Crystals and pastes, set as imitation diamonds, generally have a piece of silvered foil at the back.

Painting is sometimes resorted to for counterfeiting topazes and other gems. In this case a colourless stone, such as crystal, is employed; and the back of the stone to be enclosed in the setting is painted with the colour removed from a piece of foil, and another piece of the same foil is placed behind the stone in the setting, to improve the brilliancy. The reflection of the colour from the back of the stone is so uniformly diffused throughout its substance, that even upon close observation the unpractised eye fails to detect the absence of colour in the body of the stone. In removing the colour from the foil, the latter is gently warmed over a candle, and while warm the colour is worked up with a moistened brush, and immediately applied to the stone, care being taken to cover every portion of the back, particularly the angles formed by the meeting of the facets, as, should the smallest speck remain uncoloured, it would reflect a ray of white light that would altogether mar the effect. The painting of these fictitious gems is sometimes so successfully executed, that only those persons thoroughly conversant with precious stones are enabled to distinguish between the real gem and the counterfeit, so long as the stone remains in the setting.

Doublets are a more elegant and substantial application of the method of counterfeiting gems by coloured backs and transparent fronts. In doublets, the front and back are made in two pieces, cemented together on the line of the girdle. The front is made of a colourless stone, and the back of a coloured paste. The two surfaces to be placed in contact are first ground quite flat and smooth to fit each other accurately; they are then cemented together with a very thin layer of clear mastic, and the doublet, thus prepared, is cut as a single stone.

In real gems, advantage is sometimes taken of the power of a coloured back to give colour to a colourless front. It occasionally happens that a gem may be partly colourless and partly coloured. In this case, instead of dividing the stone, the coloured portion is placed at the back, and, if possible, the stone is so cut that the table shall be parallel to the imaginary line dividing the two portions; and if the stone has much natural brilliancy, it is not imperative that the coloured portion shall extend to the girdle, as a comparatively small piece, properly placed, will serve to colour the entire stone.

A striking illustration of this was recently observed by the writer in the case of a sapphire, the bulk of which was perfectly colourless, and a small part only of a deep blue colour. This gem was about one-sixth of an inch in length, and nearly of the same measure from the table to the cutlasse, the great proportional depth having been adopted in order that the colour might be reflected throughout the body of the stone, from the small blue portion, which was scarcely larger than the head of an ordinary pin; and yet, in consequence of its being situated exactly upon the cutlasse, and extending a small distance up the back facets, the blue colour appeared to be uniformly diffused throughout the stone when viewed from the front, although at the time of inspection the stone was not set. When viewed from the back, the body of the stone appeared quite colourless, with a small speck of a dark blue colour on the culasse.

Some management is, however, required to obtain this result, as if the stone have too much width or spread, the edges will appear colourless, and in extreme cases the blue will only show as a dark central speck. Owing to the various degrees of brilliancy in different stones, and the variation in the size of the coloured portion, no invariable rule can be adopted for the spread of the stone relatively to the depth; the proportions are therefore obtained by trial, the spread being gradually reduced without interfering with the thickness until the desired result is obtained.

English Gem Engravers.

It is very generally supposed that the ancients greatly excelled the moderns in gem engraving, and that the art has never been carried to the highest perfection in this country. Mr. Henry Weigall, however, states that, "This supposition is erroneous, and has probably arisen from the fact of travellers supposing that the collections of gems and impressions that they have made in Italy are exclusively the works of Italian artists; such, however, is not the case, and I have myself had the satisfaction of pointing out to many such collectors that the most admired specimens in their collections were the works of English artists. Selections may be made from the works of Wray, Burch, Marchant, and Charles Weigall, which will bear a comparison with the finest works that have been produced in any age or country." Mr. Henry Weigall could not, of course, speak of his own performances,

but the reputation his works have acquired in this and other countries would fully justify the insertion of his name in the above list.

Cameo Cutting.

Mineralogists generally restrict the name *onyx* to a variety of calcedony, consisting of alternate layers of brown and opaque white; but those artists who work in precious stones usually attach a much more extended signification to the name; and the following interesting particulars from the pen of Mr. H. Weigall will explain the cause of these discrepancies.

All the stones in different coloured layers employed for cameos are known to *practical men* by the general name of onyxes: but some confusion has arisen with regard to the nomenclature of stones of this class, in consequence of the imperfect information of those authors who have undertaken to describe them. It is a remarkable fact that no author who has undertaken to describe the onyx has given this simple, and, to all practical persons, intelligible description of it, namely, a stratified stone occurring in any of the semi-transparent or opaque varieties; thus there is the onyx of the sard, called the sardonyx, that of the carnelian, called the carnelian onyx, and so on through the whole variety of stones.

The name onyx is derived from a Greek word which signifies nail, and the authors before referred to have evidently been perplexed to make out any resemblance between such an object and that particular variety of the onyx which they happened to describe. Thus Pliny could see no resemblance to a human nail in the specimen from which he took his description of the onyx (which appears to have been a bad sardonyx), and he therefore thought it must be a horn or hoof, and fancied a resemblance to a horse's hoof. Theophrastus seems to have described a cloudy specimen of the carnelian as the onyx, and he fancies it resembles the pink and white colours sometimes observable on the human nail.

Mr. H. Weigall, however, suggests that there was an original propriety in the name, and that it most probably arose from the practice of the ancients in staining their nails; for if the stain were only applied at distant intervals of time, the lower portion of the nail would grow between the applications, and present a band of white at the bottom of the coloured nail, and thus render it a fair type of the onyx stone.

Mr. Weigall has made inquiries of travellers who have visited those eastern nations where the practice of staining the nails is still continued, and has found this view to be corroborated, as they agree in stating that the nails commonly present two colours exactly resembling an onyx.

Burmese Ware.

In India a thin liquid balsam obtained by incision from the *Dipterocarpus terminatus*, and one or two other trees, is commonly known under the name wood-oil, and is extensively employed as a varnish for general purposes, and also for the Burmese cups and similar ware. For common purposes the varnish is laid on with a brush, as usual; but for the Burmese ware, the second and subsequent coats of varnish are laid on and smoothed with the naked hand, both in order to preserve a fine surface and to enable the workman to discover and reject any minute particles of dirt. When first laid on the varnish appears of a light brown colour, but rubbing with the hand changes it to a fine black. When the articles have been varnished they are carefully shut up in a box to exclude the dust, and then deposited in a deep cold vault, for at least three days; which treatment is said to be essential to the proper hardening of the varnish.

The Burmese cups of small size are made of thin strips of bamboo, woven together like fine basket-work, and after the first coat of varnish the interstices of the basket-work are filled up with a paste made of wood-oil mixed with different fine powders; such as calcined bones, or very fine sawdust from teak wood. After the paste is smoothed with the hand the article is again returned to the cold vault, and when it is sufficiently hardened, the surface is smoothed with pumice-stone and water; the cups are afterwards varnished three or four times, and finely polished after the same general methods as are adapted in this country for varnished works. Sometimes the cups are ornamented with raised figures, which are made of the same paste that is used to fill up the interstices of the basket-work; the paste is pressed into tin moulds, and afterwards transferred to the bowls; when dry, it becomes hard and solid wood. At other times the cups are ornamented with engraved designs, which are afterwards filled up with different-coloured powders mixed with wood-oil, after which the surface is smoothed with wet bran held in the hollow of the hand; the operation is generally repeated to ensure the complete filling up of all the lines, and the cups are afterwards varnished and polished as usual.

A very good varnish is prepared by the Mcochees with shellac and wood-oil, heated and mixed in small quantities. They also prepare a varnish for palanquins by melting sandarach and mixing it with boiled linseed

oil rendered dripping with litharge, but they do not usually add spirits of turpentine in the manner generally adopted in England for making oil varnishes. To give an appearance of gold to the silver leaf used by the Candapilly Moochees for ornamenting boxes, palanquins, and similar objects, a little aloes is dissolved in the varnish which is laid over it.

J. Rhode, Esq., of Madras (from whose notes the above particulars were gathered) says, "I know of no better or more durable varnish for teak or furniture woods, than may be prepared by melting three or four pieces of sandarach of the size of a walnut, or small egg, and pouring upon it a bottleful of linseed oil, rendered drying by litharge, or other drier, and after boiling them together for an hour, gradually adding, while cooling, a teaspoonful of Venice turpentine. If too thick, it may be thinned by spirits of turpentine. It should be rubbed on the furniture, and after a little time, during which it may be exposed to the sun, rubbed off; the rubbing should be repeated daily, and the polish should not be again applied for eight or ten days, after which it may be slightly applied every one or two months. Water does not injure this polish, and any stain or scratch may be rubbed over with the polish; which cannot be done with French polish.

MAGNIFICENT PROJECT—GRAND HIGHWAY BETWEEN THE ATLANTIC AND PACIFIC.

Senator Benton has introduced a Bill into the Senate, for the construction of a great National Road to the Pacific. The Bill has been read twice and referred to the Committee on Roads and Canals, and ordered to be printed. The leading features of this Bill are, that "a district of territory, *one hundred miles wide*, and extending from the western frontier of Missouri to the Pacific Ocean, and corresponding to the central latitudes of the United States, shall be set apart and reserved for opening communication with California, Oregon, New Mexico, and Utah"—the road to run from St. Louis to the Bay of San Francisco, with branches to Oregon, Santa Fé, and the Great Salt Lake—the branches only to have fifty miles wide reserved strips for *their* construction. This road is to be constructed by Government, and to be free from all monopoly of individuals, and to be free, to all intents and purposes, for ever, to our citizens, who are not to pay any more toll than what will pay the road expenses. There are to be three roads constructed—one a railroad, one a wagon or carriage-road, the other for foot-passengers, and a strip to be reserved for a line of telegraph. The Bill proposes that the work shall be commenced at once, after due reports have been made on the best route, and that Government shall advance money (300,000 dollars) to commence the work, but the lands set apart are ultimately to pay the whole expenses.

In introducing the Bill, Mr. Benton made some capital remarks on the same, and presented much important information. He said that there were plenty of men in the West, the hunters, who knew every footway of the road, and by employing them, they could stake it out "as fast as a horse could trot." "There is an idea," he said, "become current, of late, that none but a man of science, bred in a school, could lay off a road—that is a mistake: there is a class of topographical engineers older than the schools, and more unerring than the mathematics. They are the wild animals—buffalo, elk, deer, antelope, and bear. They traverse the forest not by compass, but instinct, which leads them always the right way to the lowest passes in the mountains, and the shallowest fords in the rivers—the best pastures, the salt springs, and the shortest practicable lines between any two points—they travel thousands of miles and never miss the best and shortest route. They are the first engineers to lay out a road in a new country, the Indians follow them; then the white hunters in pursuit of game, then the buffalo road afterwards becomes the wagon road of the white man." Col. Benton has been informed, by hunters, that there is a way for a direct road to the Pacific. He stated that the National Road over the Alleghanies,—the military road of General Braddock,—was an old buffalo path; so was the other National Road down the valley of Kenhaua.—*Scientific American.*

RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal.*)

IMPROVEMENT IN WORKING GUTTA PERCHA. *Samuel T. Armstrong and Charles J. Gilbert.*

The nature of this invention consists in the use of lime or other alkali with heat, to neutralise the acids contained in native or crude gutta percha, and thus preserve and render more permanent its useful properties. Also in compounding lime with gutta percha for the purpose of improving its qualities and preserving it wholly or partly from deterioration, and protecting it against the action of heat and the atmosphere.

IMPROVEMENT IN PREPARING CREAM. *Charles Denison Birdseye.*

"The nature of my invention consists in

placing a quantity of pure milk in a vessel which is placed in a vapour-bath, the said vessel having a close cover with a pipe attached, which shall convey the steam and flavour arising from the evaporation of the milk through another vessel containing sugar, thereby preserving the pure flavour of the milk; the evaporation to be continued until the quantity is reduced about one-half, when the sugar is to be mixed in the milk, and the evaporation continued in an open vessel (the same being constantly stirred), until the whole becomes granulated, when it is dried sufficient to be reduced to a powder. The quantity of the sugar may be varied as desired."

Improvement for Preparing Wheat for Grinding. *Joseph W. Carpenter.*

"The nature of my invention or discovery relates to treating of wheat and other grains with an acid or a mixture of acids, to remove humidity from the grain, and make the skin or hull more easy of separation from the flour or starchy part of the grain with a less pressure of the mill-stones in reducing the grain to flour or meal; thereby producing a greater amount of fine meal or flour from a given quantity of grain (about seven per cent.), also giving to the grain, for storage or carriage in vessels, greater preservative qualities."

Claim.—"I claim the application of an acidulous composition to wheat or other grain, the said composition being principally vinegar; but I do not limit my claim to the exact composition of acids as herein described while the same effects can be produced by the vinegar alone, or when combined with one or more of the other acids, especially with the sulphuric acid, for the purposes set forth."

Improvement in Refining Gold. *James C. Booth.*

"The nature of my invention consists in the preparation of a solution of gold alloyed with silver or other metals, so as to convert them into chlorides; and a precipitation of metallic gold upon the chloride of silver and other insoluble chlorides; and in the subsequent reduction and extraction of the silver or other metals from those insoluble chlorides; or the direct extraction of their chlorides by solution in the manner hereinafter set forth, so as to leave the gold pure."

Claim.—"What I claim as my invention is; 1st, the process of dissolving alloyed gold for refining it, by developing nitric acid, or both nitric and muriatic acids gradually from their salts, in the manner and for the purpose set forth in the specification

"2nd, I claim the process of precipitating gold from its solution, and removing therefrom the insoluble chlorides, as set forth.

3rd, I claim the process of refining alloyed gold without the use of silver, so as to form a solution of gold and other metals, and a residue of chloride of silver and of other insoluble chlorides, and then precipitating metallic gold upon those insoluble chlorides in the same vessel without transfer after the solution is effected; and afterwards dissolving out the insoluble chlorides from the gold, or reducing the insoluble chlorides to the metallic state in the wet way, and dissolving out the metals from the gold, all in the manner hereinbefore described.

"4th, I claim the process, as described, of dissolving alloyed gold in wooden vessels, which may be made of any dimensions corresponding to the extent of the operation.

"5th, I claim the process, as described, of dissolving alloyed gold, by blowing steam directly into the solvent liquids, all in the manner as hereinbefore described."

For an Improvement in Stop-motion of Looms. *Elijah Hall.*

"The nature of my invention consists in allowing the lower end of the reed to hang free until the lathe arrives within a short distance of putting in the filling, when it is securely held in a position for filling by means of a moveable bar passing across the back of it, and attached by arms or brackets to a shaft working in bearings attached to the under side of the lathe; the said moveable bar being fixed by two snecks on the ends of two arms of levers passing through the lathe, and working on centres attached to the front of the lathe, being operated by coming in contact with a spring attached to the breast beam of the loom. The reed is so hung, that in consequence of any obstruction in throwing the shuttle, it will be freed entirely from the moveable bar as the lathe moves forward.

Claim.—"What I claim as new is the manner herein described of securing the moveable reed-bar and reed while the filling is being put in, and releasing them after the filling is completed, by the combination of the levers having arms and snecks, and the springs; the whole being arranged and operated in the manner substantially as herein set forth."

For a Process of Reducing Gold Bullion. *Richard S. M'Culloh.*

"The nature of my invention and discovery consists in bringing gold bullion, containing silver or other impurities, into a loose, divided, pulverulent, or spongy state, texture, or disintegrated molecular condition, so that all impurities it may contain can readily be removed by acids."

Claim.—What I claim as my invention

and discovery is, 1st, the reduction of argentiferous and other gold bullion, as a preparatory process in the art of refining thereof, into a pulverulent or spongy state, or a disintegrated or molecular condition, by the means, particularly of fusion therewith, and the subsequent removal by acids therefrom, of zinc or other metal baser than silver, which will produce the desired effect, for the purpose of then separating by acids, from such gold bullion, the silver and other impurities which it may contain, without quartation with silver or any intermediate process, in order to fit the gold for coining, and other uses.

2nd, I also claim, in addition to the above processes, the pulverising by grinding, crushing, or percussion, of gold bullion rendered brittle by union with lead, solder, or other like base metal, for the purpose set forth.

For Improvements in Removing Electricity from Wool in the Process of Manufacture. *Joseph Metcalf.*

"My improvement in the woollen manufacture consists in the discovery of a method of preventing the divergence of the fibres of the wool by electricity, without the employment of oil for that purpose; this method consists in the removal of the electricity from the wool by suitable conductors, which may be formed and arranged in various ways to suit different circumstances.

Claim.—"I claim as my improvement in the manufacture of wool, the removal of electricity from its fibres, substantially in the manner and for the purpose herein set forth, but irrespective of the form, arrangement, or construction of the apparatus by which such removal of electricity is effected."

INDUSTRIAL EDUCATION.

In the education of a mechanic, it would seem essential that the *principles* of mechanical science should be early impressed upon, and firmly rooted in the mind of the pupil, though, unfortunately, so much neglected in ordinary teaching. Dr. G. Fordyce (a most successful instiller of science) saw this—therefore commenced every course of his chemical and physical lectures with the phrase, "Matter in itself is perfectly inert;" this truth is of importance in mechanical no less than in chemical science, and a neglect of it has caused many an error and failure in the contrivance of machinery. The pupils attending those lectures were men of liberal education,—consequently knew the meaning of the terms employed; not so would the children in an Industrial School; such scholars would need to have the precise signification explained of every scientific word employed in giving them instruction; but this is usually disregarded in the ordinary mode of teaching. Take, for example, the word "matter;" the school-boy would be likely to suppose his teacher was telling him about that which was oozing from his whitlow, unless that word's first and most general signification were imparted to him. So "inert" would require to be defined. Doubtless the great art in teaching is, that of never passing on from one word or one subject to another until the first is fully comprehended by the pupil; hence a parent should not be discouraged though his child might learn apparently little, but that little well,—although he might be unable to repeat learned phrases by rote, without comprehension of their meaning frequently, as is so often the case in regard to the show-off exhibitions on public days at schools.

As in a mechanical education it is essential to teach the inertia of matter, so in regard to the mechanical powers a right comprehension of their real use should be inculcated. According to a note left by Sir Samuel Bentham, they should be defined as "so many means of enabling a man to be *longer about* any operation than he would be without them; or, in other words, the enabling him to apply *continued* exertions in the performing of some operation that surpasses his transient muscular strength. Thus, if a child can lift a five pound weight, and no more, to the height of *one* yard only in *one* minute, by the use of the mechanical powers, he may be enabled either to lift a *double weight* to the same height in, say, *two* minutes instead of one, or to raise the five pounds *two* yards high in *two* minutes;" and he added—"This kind of language would of itself do away with many mistaken notions in mechanism,—such, for instance, as the making of perpetual motions."

It was Sir Samuel's intimate knowledge of, and adherence to the principles of mechanics, that enabled him to introduce improvements in the most common articles of household furniture, as well as into that complicated piece of mechanism, the navigable vessel,—that is, improvements contributing to their strength. It is upon those same principles that

so many late improvements have been devised; and it is only by attention to them that further progress in the same direction can be expected. Many of Sir Samuel's innovations have, by degrees, been generally adopted—others are still neglected, notwithstanding the great advance that has been made in a knowledge of mechanical principles. Common chairs, for instance, of which such innumerable quantities are fabricated, are still made without regard to the strength afforded by the diagonal truss or brace; hence the common chair, either soon by rocking, falls to pieces in use, or a superfluous quantity of materials has been used for it, compared to what would have been required had diagonal braces been introduced in its construction. The ancients, though without our knowledge of mechanics, yet often observed the principles of them in practice; many of their chairs, as exhibited in remaining representations of them, were strongly made by means of diagonal braces. There happens to be still amongst Sir Samuel's papers some sketches of chairs in which this principle was introduced; he had some such made about fifty-seven or fifty-eight years ago for use in his workshops in Queen-square Place; about only half the usual quantity of beech wood entered into them—yet after they had been tossed about and roughly used for many years, they had not a single rickety joint amongst the whole set when last examined. The spiker-legged tables of the early part of the last century afforded good examples of the strength given by diagonal braces—called *spider-legged*, because their legs were so extremely slender, their strength depended on the judicious introduction of diagonal braces; such tables are out of fashion now, though so strong, so pretty, and so light in fact as in appearance. Diagonal braces were introduced in his experimental vessels of 1795, amongst other mechanical contrivances for giving them strength, and they contributed greatly to the extraordinary degree of it those vessels exhibited. Sir Robert Seppings, at a subsequent period, claimed as his invention this improvement in naval architecture; and the merit of it has very generally been ascribed to him, although his first application of diagonal braces was in the repair of a vessel subsequent to the time when Sir Samuel's experimental vessels were at sea in actual service. Sir Robert's mode of applying diagonal braces was at the *sides* of the vessel, where the planks connected with the ribs afford sufficient strength in the ordinary mode of construction; Sir Samuel's diagonal trusses and braces were in parts of a vessel particularly weak in the then usual structure of it, for he comprehended them in bulkheads that were *fixed*, and also between the pillars in other parts of his vessels which theretofore had exhibited signs of excessive weakness. This same principle of giving strength by the form of trussing and bracing has been introduced in iron structures with great beauty and good effect—as, for instance, the girders of the "Crystal Palace;" and those persons who profess apprehensions of the want of strength of that structure as a whole, ascribe the deficiency to a general disregard of diagonal trussing and bracing.

The principle in mechanics, that a given quantity of material affords much more strength when spread out in a tubular form than when in a solid mass, is also of great importance, and should be carefully inculcated during the education of a young mechanic. Telescope tubes are of old a proof of this principle; but probably the first application of it to domestic furniture was by Sir Samuel Bentham in the year 1791, as his patent for tubular fire-irons bears date. A set of them, manufactured shortly afterwards, and kept in store till the year 1828, have been in constant and somewhat careless use from that time to this (twenty-two years), and still continues so, yet show no sign of defect other than some loss of their first brilliant polish; the tongs weigh but half as much as those of the usual make; the poker has an advantage derivable from attention to the effect of gravity, the ring in lieu of knob being light, and also the tubular stem, the fire-bit solid; the consequence of course is that should the poker be left in the fire till red-hot, and then fall out, the weight of the bit carries it *within* the fender, instead of falling upon and burning rug or carpet. Of late many articles of metal for furniture have been made tubular—for instance, bedsteads in great number.

It was because the strength of a given quantity of material is greater when tubularly disposed than when in a

solid mass, that Sir S. Bentham proposed, in 1810, hollow masses as one mode in which a breakwater might be economically constructed in Plymouth Sound; and the embankment of the Thames was for this, amongst other reasons, designed to be hollow instead of solid; as submitted to the Commissioners for the Improvement of the Metropolis, in a communication compiled from his papers (*Mechanics' Magazine*, No. 1399). Professor Cowper, in his late lecture in the Crystal Palace, expatiated on the great strength resulting from the disposition of materials in tubular columns, in comparison with the use of the same quantity of materials in a solid mass. The Conway and Britannia Bridges are constructed on the same principle; and in shipbuilding it might be introduced with great advantage, as indicated by Sir S. Bentham (*Mechanics' Magazine*, No. 1390), where he suggested that tanks should, in this view, form a part of the vessel itself.

These particulars have been entered into as indicating the kind of instruction it were desirable should be given to the young mechanic, not as an extensive exposition of the principles he should be made familiar with — far from it; a detail of the several heads of information that should be imparted to such a pupil is more the province of the directors of normal schools than of the *Mechanics' Magazine*. Enough, it is hoped, may have been said above to show the kind of instruction which, in addition to early practice in manipulation, should constitute, together with religious and literary knowledge, the education of children destined for any mechanical craft or science.

It may be added, that intellect in early childhood is quite equal to the comprehension of fundamental truths, such as are the principles of mechanics; that the young mind has pleasure in the acquirement of such knowledge, that is, if instilled gradually, and never forced upon it as a task, or in amount beyond its powers of retention. Little experiments, elucidating any principle, the subject of a lecture, are particularly interesting to children, and impress facts forcibly on their minds.

Lectures to children, and those too of the humbler classes!—Why not? By lectures, information can at the same time be communicated as well to some hundreds of children as to a single one. It appears to have been chiefly by oral instruction to great numbers at the same time, that so much was taught at the Hague, by so small a number of teachers. Lectures were particularly recommended in the plan for naval seminaries; an approach to this mode of instruction is now becoming common in some schools for gratuitous instruction, and it is adopted in many of the highest description of schools for the gentry.

M. S. B.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JANUARY 16, 1851.

JAMES THOMSON, of Glasgow, civil engineer. *For improvements in hydraulic machinery, and in steam engines.* Patent dated July 3, 1850.

Claims.—(In respect of the case-wheel, described p. 42,) I claim the same in the peculiar combination and arrangement of the parts, or methods of which it consists, or of any two or more of them which may in practice be combined together to the exclusion of the others; that is to say, the several parts or methods following, namely:—1. The employment of a stationary outer case with entrance orifice, or orifices, of such capacity that when all the water is flowing through, its velocity may be that which is due to half the fall, or nearly so; together with the arranging of the connection between the moveable wheel and the machinery to be driven by it, in such a way as that when the machinery is going at its proper speed, the moveable wheel may have such a velocity as that the centrifugal force of the water contained in it when straight vanes are employed, or the centrifugal force, and the force necessary to send the water back through the orifices between the vanes at the centre, when curved vanes are employed, may balance the other half of the fall, or nearly so. 2. The giving of a spiral, or a spiral-like form, to the inside of the case facing the circumference of the moveable wheel, for the purpose of causing the water to move as nearly as may be uniformly towards the centre, while it revolves with the wheel in the case. 3. The forming of the moveable wheel with the top and bottom plate, having between them radiating passages leading into the centre of the wheel, and bounded laterally by straight or curved diaphragms with a disc boss, or other equivalent contrivance, to connect the diaphragms with the shaft, and with two central orifices for discharge, one in the top and one in the bottom plate.

4. The forming of the curved vanes (when used) according to the principles and rules hereinbefore given. 5. The adaptation of a cover or lid to the case. 6. Making various parts of dimensions depending on the height of fall and quantity of water, as set forth in the calculations and rules hereinbefore contained. And 7. The arrangements for regulating the supply of water to the wheel.

2. *In respect to the suction wheel*, I claim the same in the general combination and arrangement of the parts or methods of which it consists, or of any two or more of them which may in practice be combined together to the exclusion of the others; that is to say, the several parts or methods following, namely:—1. The combination in one of a moveable wheel and suction-pipe. 2. The use of nozzles having orifices long, narrow, and adapted to the slope of the surface of the whirlpool. 3. The making of the outer lip of the moveable wheel project beyond the inner one, for the purpose of securing a tangential motion to the water. 4. The use of a vent-pipe, for admitting air on certain occasions to the suction-pipe. And, 5. The regulating apparatus depending on the principle of employing a small quantity of water, which is allowed to fly off from the circumference of the wheel.

3. I claim the adaptation of a centrifugal pump to the controlling of machinery driven by water-wheels, or by any other motive power, in the manner therein exemplified and herein before described; as also the combination of the pump with the self-acting apparatus, having a bucket with a hole in its bottom for working the sluice of the water-wheel.

4. And in respect of my improvements in steam engines, I claim, 1. The freeing the steam from water by drawing the steam off from the centre of a whirl, while the water passes away at or near the circumference, by the apparatus represented and described, or any suitable modification thereof. 2. The arrangements for permitting the water to return to the boiler by its own gravity. And, 3. The close cistern, with a valve worked by a float, for permitting the water to escape after the steam in each case has been removed, by having been drawn off from the centre of a whirl.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman. *For improvements in the preparation and manufacture of caoutchouc or India-rubber.* (A communication.) Patent dated July 9, 1850.

This invention consists in combining or compounding with caoutchouc the substances known as gum lac, gum shellac, stick and seed lac, either by grinding or triturating them together, or by means of suitable solvents. The range of proportions specified is from one to eight parts of either of the substances named, to one part of the other substance named. The greater the quantity of shellac, the harder, stiffer, and less elastic will be the compound, and *vice versâ*. The advantages claimed for this admixture, are that the caoutchouc is more economically manufactured and deprived of its unpleasant odour.

It is recommended to sprinkle the surface of thin fabrics made from this compound, with finely powdered sulphur, and to expose such articles to the rays of the sun to remove tackiness. The same ingredients is also proposed to be generally introduced in the manufacture of caoutchouc and shellac, either by mechanical or chemical means.

Caoutchouc and shellac dissolved in any suitable solvents, such as camphine, for instance, form a useful cement, which may be further improved by the addition of a small quantity of sulphur.

The vulcanizing or curing process, and the admixture of earths, carbonates, and other metallic salts as practised and well understood by manufacturers of India-rubber, is recommended to be adopted in certain cases, as part of the treatment of the substances compounded as above described.

Claim.—The use of gum lac or shellac in its various forms in the preparation and manufacture of caoutchouc or India-rubber, with or without the application of artificial heat, substantially as described.

Jacob Connop, of Hyde-park, gentleman. *For improvements in melting, moulding, and casting sand, "earth, and argillaceous substances" for paving, building, and various other purposes.* Patent dated July 10, 1850.

Mr. Connop observes that he has discovered that the part of his invention which was to have been included under the words "earth and argillaceous substances" does not possess sufficient utility (*query* novelty?) to warrant his claiming its exclusive use, and that it is his intention, in consequence, to apply for leave to enter a disclaimer thereof. He then goes on to state that, although the melting of sand with various fluxes is a well-known operation in the manufacture of glass, still the application of this process to the formation of bricks, slabs, steps, mantel-pieces, pipes, tubes, inverts, and such like articles adapted for paving and building purposes, and for the conveyance of liquids under streets and through land, is new, and constitutes, in fact, the invention claimed by him.

The methods of, and apparatus employed in such melting, casting, and moulding

together the materials used (which are of the cheapest and commonest description), are in every respect identical with those practised and applied in the manufacture of coarse bottle glass; but as, in this case, transparency is by no means an object, the operation of "refusing" is dispensed with. While in a heated state, the articles (moulded into the desired forms) are placed in annealing ovens of the ordinary circular construction, with sand or cementing matter between them to prevent their coming in contact. The temperature of the oven is then raised to a white heat until the articles assume a dull brown colour, after which it is gradually reduced, when they will have become devitrified, and may be used as required.

The patentee makes no claim to any of the above processes when separately considered, or when employed otherwise than for the purpose of his invention, which consists in the manufacture of articles for paving, building, and other similar uses, from sand, by melting, moulding, casting, and treating it in the manner described.

Robert Rumney Crawford, of Warden Paper-mill, Northumberland, papermaker. *For an improvement in drying paper*. Patent dated July 10, 1850.

The first part of this invention has relation to a machine for drying sized paper in the web or in long lengths. The paper is carried between tapes over rollers through a series of horizontal tubes, into which hot air is admitted in the same direction as the paper travels. The moisture will be absorbed by the heated air, and pass off in the form of vapour.

The second head of the invention embraces four methods of drying sized handmade paper, and that which is in sheets. The first method of effecting this object is by means of the apparatus just alluded to; but netted sheets are substituted for tapes for carrying the paper. The second method consists in the employment of reels or drums, with reticulated sheets for carrying the paper, which is dried by hot air rising against it, as before. It is proposed, thirdly, to employ cylinders heated by steam, some or all of them being covered with felt, strips of wood, or other non-conducting substance, the paper being kept in contact therewith by tapes or nets, as before. For drying common paper, the felt covering for the drums may be dispensed with. Fourthly, one large drum, revolving at a slow rate, and carrying the paper held against its surface by tapes or nets, is employed. In this case heated air is caused to rise against the paper. A steam-heated cylinder may be substituted for the drum, and the paper held in contact therewith by tapes.

No claims.

James Hill, of Staleybridge, Chester, cotton spinner. *For improvements in or applicable to certain machines for preparing cotton, wool, and other fibrous substances for spinning and doubling*. Patent dated July 15, 1850.

The improvements here specified and claimed are—

1. Imparting a varying velocity to cans or other receptacles in which the slivers are delivered by preparing machines, whether such cans rotate continuously in one direction, or wholly or partially first in one direction and then in the other.

2. Coiling the rovings or slivers between two plates or discs, the upper one of which revolves at a uniform velocity, and the lower one at a varying velocity, by means of positive mechanical arrangements instead of by friction,—imparting motion to the upper plate from below and outside the lower one by means of a casing or of rods,—applying a weighted lever to give pressure to the lower plate,—and the employment of a casing attached to the spindle of the lower plate to protect the coil.

3. An improved bobbin frame for winding the slivers with a greater or less amount of twist on conical spools or bobbins, to which a varying velocity is imparted by means of differential wheels in combination with a friction disc and scroll.

4. Any mechanical arrangement for imparting an up-and-down and gradually lowering motion to the copping-rail without disengaging any part of the gearing during the operation of filling the spools or bobbins.

5. Giving an uneven surface to conical bobbins or spools by means of grooves or otherwise, so as to prevent the slipping of the sliver at the commencement of winding.

Tempest Booth, of Ardwick, Lancaster, gum manufacturer. *For certain improvements in the methods of, and apparatus for obtaining and applying motive power*. Patent dated July 15, 1850.

The principle on which these improvements is based is that of the old and well-known smoke-jack, and in which a current of air produced by combustion is caused to act on a series of vanes, and impart a rotary motion to the shaft on which they are mounted. The machines described by Mr. Booth are stated to be applicable to various purposes where rapidity of motion without much power is required.

The claims embrace the several methods shown of constructing and arranging the vane-wheels, case, &c., and a new construction of furnace to be employed in combination with apparatus of this description.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Henry Griswell, of the Regent's Canal Iron Works, Middlesex, engineer, and Theophilus Redwood, of Montague-street, in the same county, professor of chemistry, for improvements in coating metals with other metals. January 11; six months.

John Alexander Archer, of the Broadway, Westminster, tobacco manufacturer, for improvements in the manufacture of tobacco. January 11; six months.

Samuel Hall, late of Basford, near Nottingham, civil engineer, for improvements in the manufacture of starch and gums. January 11; six months.

William Melville, of Roe Bank Works, Lochwrinnoch, Renfrew, North Britain, calico printer, for certain improvements in manufacturing and printing carpets and other fabrics. January 11; six months.

Thomas Allan, of Glasgow, Lanark, North Britain, ironfounder, for certain improvements in paving or covering roads, streets, and other surfaces of a similar nature. January 11; six months.

George Anstey, of Brighton, Sussex, gentleman, for certain improvements in consuming smoke, and in regulating the draught in chimneys. January 11; six months.

William Robinson, of Holsham, in Holderness, in the East Riding of the county of York, machinist and agricultural implement maker, for improved machinery for separating corn from straw. January 11; six months.

John Clarkson Milnes and Samuel Pickstone, of Radcliffe Bridge, Lancaster, manufacturer, for certain improvements in machinery or apparatus used in spinning, doubling, and weaving cotton, flax, and other fibrous substances. January 11; six months.

Alexander Speid Livingstone, of Swansea, Glamorgan, engineer, for improvements in the manufacture of fuel. January 11; six months.

Charles Barlow, of Chancery-lane, London, Esq., for improvements in propelling. (Being a communication.) January 11; six months

Charles Barlow, of Chancery-lane, London, esquire, for improvements in machinery for the manufacture of railway chairs. January 14; six months.

Gustav Adolph Buchholz, of Agar-street, Strand, Middlesex, civil engineer, for improvements in printing, and in the manufacture of printing apparatus, and also in folding and cutting apparatus. January 16; six months.

Robert Cogan, Leicester-square, Middlesex, glass merchant, for improvements in the application of plain or ornamental glass alone, or in combination with other suitable materials, to new and useful purposes of construction or manufacture. January 16; six months.

Charles Cowper, of Southampton-buildings, Chancery-lane, Middlesex, for improvements in the construction of apparatus for manufacturing, and apparatus for retaining and drawing off soda-water and other aerated liquors. January 16; six months.

Frederick Watson, of Moss-lane, Hulme, Manchester, gentleman, for improvements in sails, rigging, and ships' fittings, and machinery and apparatus employed therein. January 16; six months.

Charles William Lancaster, of New Bond-street, Middlesex, gun-maker, for improvements in the manufacture of fire-arms and cannons, and of projectiles. January 16; six months.

Jean Marie Taurines, of Paris, engineer, for certain improvements in the machinery and apparatus for measuring and regulating the working of engines. January 16; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 9	2624	Edward Upward	South Molton-street	Respirator pipe.
"	2625	Mary Ann Allison	Nottingham-place, Stepney	Detective pocket guard.
11	2626	Thomas Starkey	Birmingham	Button.
"	2627	Thomas Fuller	Kingsmead-street, Bath	Landau carriage body.
13	2628	Samuel and Fredrick Hattersley	Westbrook Works, Bradford	Eccentric cane, with joint for woolcombing.
"	2629	John Mark	Exeter	Machine for cutting lasts.
"	2630	John Paterson	Wood-street	Polka collar.
14	2631	Thomas Clunes	Aberdeen	Rotary pump.
"	2632	Leopold Etting	Princes-square	Ships' scuttle.
"	2633	George Bodley	Broadway, Westminster	Safety and ventilating revolving and sliding window-sash.
"	2634	George Ellis	Fore-street, City	Lady's fur cuff.

CONTENTS OF THIS NUMBER.

Specification of Thomson's Patent Case Water-Wheel—(*with engravings*) 42
Anhydrous Steam.—Dr. Haycraft in Reply to Mr. Frost 46
Law of Resistance to the Passage of Bodies through Water 47
New Table of the Values of Survivorship Assurances 48
Holtzapffel's Turnery and Mechanical Manipulation. Vol. III 50
Magnificent Project.—Grand Highway between the Atlantic and Pacific 53
Recent American Patents:—
- Gutta Percha .... Armstrong 53
- Preparing Cream .... Birdseye 53
- Wheat-grinding .... Carpenter 54
- Gold-refining .... Booth 54
- Looms .... Holt 54
- Gold Bullion .... McCulloh 54
- Wool Manufacture .... Metcalf 55

Industrial Education 55
English Specifications Enrolled during the Week:—
- Thomson .... Hydraulic Engines 57
- Newton .... India Rubber 58
- Connop .... Moulding and Casting 58
- Crawford .... Drying Paper 59
- Hill .... Spinning 59
- Booth .... Motive Power 59

Weekly List of New English Patents 60
Weekly List of Designs for Articles of Utility Registered 60

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MR. THOMSON'S PATENT SUCTION WHEEL, CENTRIFUGAL PUMP-REGULATOR AND STEAM ENGINE PRIMING PREVENTOR.

Fig. 12.

MR. THOMSON'S PATENT SUCTION WHEEL, CENTRIFUGAL PUMP-REGULATOR, AND STEAM ENGINE PRIMING PREVENTOR.

Specification.

(Concluded from page 46.)

SECONDLY, my invention consists of another apparatus for obtaining motive power from water, which, as a whole, I call a suction wheel. Fig. 12 is a vertical section, and fig. 13 a plan of this apparatus. A is the moveable wheel, and BB are fixed nozzles (represented as four in number in the engravings, though this number is not essential), which receive water from a supply pipe C, and spout it into the upper part of the moveable wheel, as indicated by the arrows on the plan. This upper part is a sort of shallow cylindrical tub, and the water in it flies out by centrifugal force so as to form a whirlpool, the average surface of which is shown by the lines *ni*, *ni*, fig. 12. The part marked *j* is a rim which projects inwards at the top of this tub to prevent the water from flying over the top, except in small quantities. The part which may be regarded as the bottom of the tub is double, and in the space between the two bottoms are placed radiating vanes *e*, *e*, which are analogous in their nature and office to those already described in the case wheel with staight vanes. The moveable wheel terminates at bottom in a straight suction pipe *k*, and the weight of the column of water in this removes part of the atmospheric pressure from the inner ends of the vanes, and thus allows the atmospheric pressure in the tub to urge the water from the tub through the annular space *e*, and between the vanes towards the centre against the centrifugal force. The wheel turns on a pivot *p*, like that of the case wheel already described, and the upright shaft E of the wheel passes through the centre of the descending knee F of the supply pipe, and works in a bearing D. The water is prevented from escaping round the upright shaft by a tube, *o*.

Each nozzle is made so that it will spout the water as nearly as may be perpendicularly to the plane passing through its mouth and the axis of the wheel. The mouth of each is made long and narrow; and its outer lip is placed almost in contact with the surface of the whirlpool before mentioned, so that the water may have to fly outwards and fall, as little as may be, in passing from the mouth to the surface of the whirlpool. As horizontal lines along the plate which forms the inner lip are not perpendicular to the plane passing through the mouth of the nozzle and the axis, the outer lip is made to project a little beyond the inner, as shown in fig. 13, so as to give the proper direction to the water. The orifices are placed midway between the upper and lower levels: and thus (as in the case wheel) one-half of the fall is expended in producing the velocity with which the water enters the wheel, and the other half acts in combination with the motion of the wheel in staying that velocity again.

The following are the best directions which I am able to give for determining the dimensions and forms of the different parts of this apparatus:—Fix on the diameter of the suction pipe, making it not larger than what is considered necessary to permit the passage of the water with sufficient freedom. I would recommend that a head of from two to four per cent. of the entire head should be expended in producing the velocity and overcoming the friction of the water in this pipe. Then, YH being the lower level of the water, and KL the axis of the wheel, make KM equal to this portion of the entire head. At any convenient distance from the axis (usually not less than two or two and a half times the diameter of the suction pipe) and midway between the upper and lower levels, fix on P as the middle point of the outer lip of a nozzle. Draw *ni*, as a tangent to a parabola passing through P and M, and having its axis coinciding with the axis of the wheel. Make the outer lip of the nozzle to lie along *ni*, and the inner to be as near it as other circumstances (such as the depth which may be thought allowable for the tub) will permit. The narrower the mouth is made the greater must be its length, so that it may permit the passage of the requisite quantity of water, but, at the same time, the narrower it is within any moderate limits, the better will the new water be laid on the wheel. Make the ends of the vanes be at the same distance from the axis of the wheel as the point P. The speed of the wheel will be determined by making the ends of the vanes move with the velocity due to the fall from P to M. The chief deviation which I think

might perhaps be advantageously made from the foregoing directions, would be to fix on the point P a little lower than the position assigned to it, as I would prefer that the velocity of the water at the outer extremities of the vanes should be greater than the velocity of these extremities, rather than it should be less.

Fig. 17.

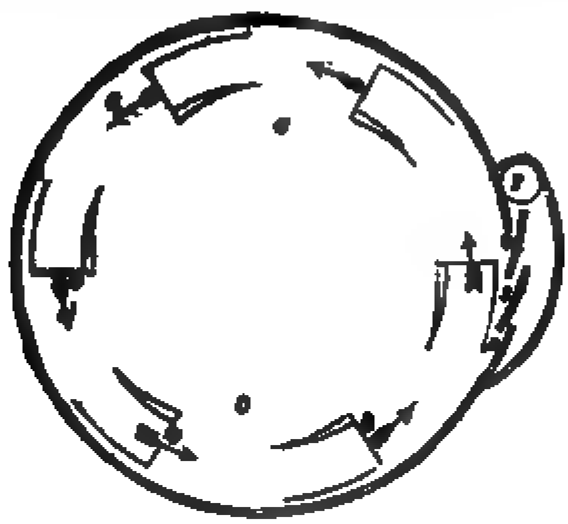


Fig. 15.

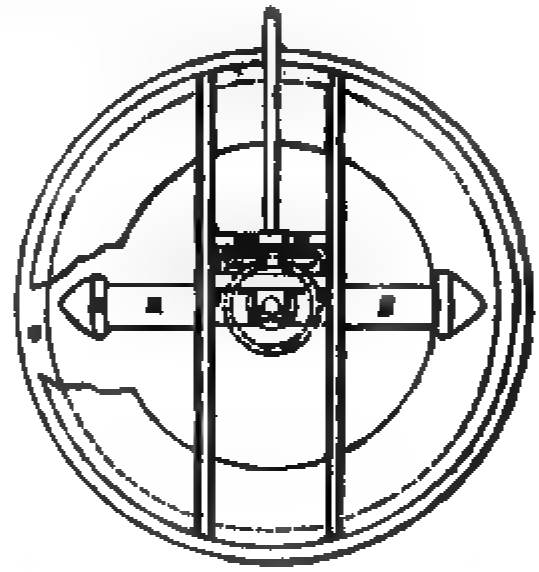


Fig. 16

Fig. 14.

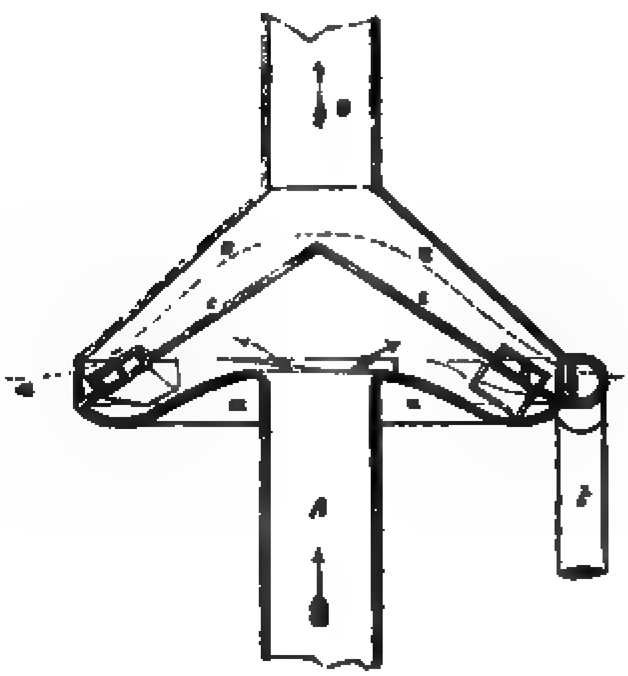


Fig. 18.

It may be well to have a little space, as shown in fig. 12, between the bottom of the nozzles and the plate m which covers the vanes, so as to allow any bubbles to

escape which may be introduced into the whirlpool. As an additional security against any of these, or at least any large ones passing through the annular space *l*, the plate *m* may be made to project a little beyond the ends of the vanes as shown in the engraving. It may also be found advantageous to add a vent pipe *a*, by means of which a small quantity of air may be conveyed to the suction pipe, before a great rush of air can pass downwards through the annular space *l*.

For regulating the supply of water the width of the mouth of each nozzle is made variable. The plate *r* forming the inner lip is attached to the fixed portion of the nozzle by a watertight hinge, which may be made of leather, or of strong waterproof cloth, and the top and bottom of the nozzle adjacent to this plate are also made of one of the same, or of some other suitable material or materials. The internal diameter of the rim *j*, which projects inwards at the top of the wheel, may perhaps be made as large as the distance from the outside of one nozzle to the outside of the opposite one. Should it however be made smaller, notches *n* should be made to admit of the nozzles being let down into their places. The depth of these notches, or the internal diameter of the rim, must be adjusted, so as to keep the surface of the whirlpool up to the place assigned to it, but to allow a little of the water to fly out when the surface reaches that position, and of course more to fly out when the surface approaches nearer to the centre. Round the top of the wheel is placed a circular stationary trough G, adapted to catch the drops of water which fly over the top, and to collect them and let them fall into a bucket *b*, having a hole in its bottom. This bucket is connected by means of cords, pulleys, and levers, or in any other suitable way, with the hinged plates, which form the inner lips in such a manner, that when the bucket becomes heavier, in consequence of the supply of water from the trough to it, being more than the expenditure by the hole in its bottom, may descend and partially close the mouths of the nozzles, and that when the bucket becomes lighter from the opposite cause it may ascend and allow the mouths to open wider. Thus the water will always remain almost exactly at the same height or distance from the centre, and the wheel will revolve almost exactly at the same rate, even though the work which it is required to perform should happen to vary considerably. The system of pulleys, levers, &c., represented in the figures, will be easily understood. The bucket hangs from the side J of the pulley J. A cord *s* passes from the opposite side of the roller V, on which the pulley is fixed to one end of a lever *z*. The other end works the hinged plate *r* by means of the connecting-rod *y*. A similar lever z_1, is worked in the same way by another cord hanging from the roller V, and other two similar levers z_2, z_3, are worked by cords *w*, *w*, passing from the top of the roller and over the pulleys N, N, to the ends of those levers. To prevent the bucket *b* from sinking too low, when water contained in it becomes sufficient in quantity to weigh it down, and from rising too high, when the water in it becomes small enough in quantity to allow it to ascend, or, in other words, to make the bucket always assume its proper position and remain there steadily as long as the quantity of water required by the wheel remains unaltered, a spring (not shown in the engraving) should be so connected to the pulley J, or to some other part of the regulating apparatus, as to serve as a counterpoise to the weight of the bucket. The quantity of water which must accumulate in the bucket to depress it from the top of its range to the bottom, depends on the elasticity of the spring adopted. This elasticity may vary within very wide limits. The least stiffness which the spring should have, is that which is just sufficient to prevent the bucket from starting up and down in the manner before described; but no evil effect would be produced by the spring's having greater stiffness, provided that this were not so great as to require an inconveniently large bucket, which might operate too slowly, unless an otherwise unnecessarily large quantity of water were kept flowing through it. Instead of a spring, a weight hanging from a pulley, with a varying radius like the fusee wheel of a watch, may be employed.

If the surface of the whirlpool in the wheel be at exactly the best height, that is, if it be as near the nozzles as possible without touching them, more water will fly over the edge of the wheel into the trough G in a given time when the mouths of the nozzles are wide open, than when they are nearly shut. Hence it is desirable, hough not necessary, that the water should be allowed to flow through the orifice

in the bottom of the bucket at a greater rate when the bucket is at the top of its range, than when it is at the bottom; that is to say, the water should be discharged from the bucket most rapidly while it contains its least load, and least rapidly while it contains it greatest load. To fulfil these conditions, all that is necessary is to hang within the orifice of the bucket a tapered plug *f*, fig. 12, with its small end uppermost, by means of a rigid rod *g*, and to suspend the bucket by means of a spiral spring *h*, so that as the load of water increases, the bucket may descend in reference to the plug and the area, for the exit of the water may thus be diminished. The proper diameter of the plug at each part of its length may be readily determined by experiment when the wheel is in action.

Thirdly—My invention consists of a Centrifugal-pump Regulator for controlling the speed of machinery driven by water-wheels, especially those commonly called bucket or overshot wheels. Figure 14 is a sectional elevation of a regulator of this kind, and fig. 15 is a plan. A is an upright revolving tube through which the water ascends to the revolving arms B, B. The tube and the arms are the chief parts of the pump. The pump turns on a pivot shown at F, and it is made to revolve by being connected by means of a tubular upright shaft M, surmounted by a solid one D, with the machinery, whose speed is to be regulated. A valve F prevents the water from descending, but allows it to ascend freely. The upper extremities of the arms, or the discharge orifices, are better to be made oblong, as shown at C, fig. 15, than circular. K, K are tie rods for strengthening the arms. G is a circular wall, which serves as a support for the upper bearing of the pump, and also to confine the water thrown up by the pump, so as to make it fall back nto the well H. The connection between the pump and the machinery to be regulated should be so arranged, that when the machinery is going at its proper speed the centrifugal force may balance, or nearly so, the gravity of the water in the pump, which it will do when the upper discharge orifices C, C, move with the velocity which a heavy body would attain in falling from C to the water level, L L, fig. 14. The pump should be kept usually raising a moderate quantity of water, and then when the machinery goes a little too quickly, the pump will raise a much greater quantity of water, and will thus occasion an increased resistance to the motion of the driving water-wheel, and *vice versâ*. The speed of the machinery may be altered at pleasure by altering the water level L, L. If a man be employed to take charge of the driving wheel, he should diminish the supply of water to it whenever the centrifugal pump is raising too much water, and he should increase the supply whenever the pump is raising too little. If, however, the supply of water for the driving wheel be scanty, so that it must be economised, even at the cost of allowing the machinery to go occasionally too slow for a short time, he should keep the pump usually raising no water, but just on the point of raising it. The apparatus will thus be ready to check any excess of speed which may tend to occur. Instead of the man, a self-acting apparatus, such as that already described for the suction wheel, may be employed. For this purpose, the bucket with the hole in its bottom would be supplied with the water thrown up by the pump, and would be made to act on a sluice, or some equivalent contrivance for adjusting the supply of water to the driving wheel. The pump may have various forms. Thus the moveable wheel of my suction water wheel, with a valve added to prevent the water from descending, would be a good form.

Fourthly—My invention consists of an improvement in steam engines, whereby the steam is freed from any water whichmay be carried along with it. The mode in which thewater is separated from the steam is as follows:—The steam is made to flow into a circular vessel tangentially, at or near the circumference, and to pass away from the vessel at the centre. The steam and water in the vessel are thus subjected to a rapid whirling motion, and the water flies outwards by the centrifugal force and passes away from the vessel by an aperture, or apertures, at the circumference. The water on leaving the vessel may be disposed of in various ways, as will be presently more particularly explained. The apparatus may be applied to the engine in various situations according to convenience, or to the purpose to be served. Thus it may be applied to the steam pipe, either without or within the

boiler, and it may be applied at the top, or at any other part of the waste steam pipe. Figs. 16, 17, and 18, represent it as it would be applied to a vertical pipe through which the steam ascends. Fig. 16 is a vertical section, and fig. 17 is a plan in section along the line *a*, *b*, in fig. 16, and fig. 18 is a section of one of the orifices *o*, in the diaphragm *c*. Through the explanations already given, and by reference to the arrows on the figures, it will be seen that the steam is injected into the circular vessel B, tangentially through the orifices *o*, that therefore it must exist in the vessel B, in a whirling state, and that it passes away by the pipe D from the centre of the whirl. The water leaves the vessel B by the orifices *s* at its circumference, and is conveyed by a pipe *t* to any required place. If, for instance, A and D be parts of the steam pipe leading from the boiler to the cylinder, and the vessel B be placed sufficiently high above the level of the water in the boiler, the water may be allowed to descend into the boiler by its own gravity through the pipe *t*, which would then be made to terminate in the boiler near its bottom. When this arrangement is adopted, a valve opening towards the boiler may be found requisite in the pipe *t* to prevent regurgitation of the water. Again; the pipe *t* may lead the water to a close cistern, having in its bottom a valve which is opened by a float whenever the water accumulates in the cistern to a certain amount. The water can be returned to the boiler by the feed pump. If the apparatus be placed on the waste steam pipe of a steam boat engine, the pipe *t* may convey the water into the paddle box; and the escape of a little steam along with the water will not be detrimental. In locomotive engines for railways, the apparatus should be placed within the steam chest. The pipe A and the plate *m* are in that case omitted, and instead of the steam pipe D, a similar pipe leads downwards from the centre of the diaphragm *c* towards the cylinder.

ON IMPOSSIBLE EQUATIONS. BY ROBERT HARLEY, ESQ., MEMBER OF THE MANCHESTER PHILOSOPHICAL SOCIETY, ETC.

(Continued from p. 29.)

[*Note by Mr.* Cockle.—"The date of my note, printed *supra* p. 28, and which accompanied the introductory portion of Mr. Harley's paper, should have been *November* 3, and not 'October 3.' I ought to add that, in a letter dated October 11, 1850, Mr. W. Spottiswoode (whose attention, as well as that of Mr. Harley, was directed to the equation in question by my article in the *Philosophical Magazine* for last October,) intimated to me that the reciprocal of zero is the root of the equation discussed *supra* p. 21, col. 8. Mr. Spottiswoode did not however go into any details beyond suggesting that such was the fact. If we adopt the rule of signs which I gave at p. 491, of vol. xlvi., of the *Mechanics' Magazine*, the expression,

$$(\infty - r)(+1)^2 + \infty(-1)^2,$$

in which 0 and 1 are the limits of r, is a root of that equation. In Mr. Harley's elegant expression for the root (which I consider as an ingenious combination of the ordinary symbols of algebra, and not as belonging to a new species of imaginaries) r is zero. It seems to me that the equation is not an impossible one.

"Since I last communicated with the *Mechanics' Magazine*, we have received at the hands of Death another awful lesson, in the decree by which he has erased the name of Davies from the list of its contributors, and removed him who has rendered the name so memorable, from his friends and that world of Science which will cherish his memory for ever. His name must ever rank among the foremost of the many immortal ones which Britain has added to the scroll of geometers.

"In connection with the class of subjects treated of in these papers, it may not be uninteresting to add here, that, when I first entered upon these speculations, I mentioned to my lamented friend Professor Davies that I was about engaging in researches that might possibly enable us to determine *à priori*, what results do and what do not belong to a given question, and so to exclude foreign factors. The Great Geometer, with that promptitude and energy which he always displayed when any

projected improvement in mathematical science was the topic, instantly and with earnestness intimated a strong opinion of the importance of the investigation. In such approval I might find an apology for any attempts however unsuccessful.

I am, Sir, yours, &c.,
JAMES COCKLE."]

"2, Pump-court, Temple, January 20, 1851.

Continuation of Mr. Harley's Paper.

Dividing both members by A, the equation (a) is readily reduced to the more convenient form

$$x + \sqrt{2\,ax+b} = c \ldots\ldots\ldots (a')$$

$$\text{where } a = \frac{\mathrm{B}}{2\,\mathrm{A}^2}, \quad b = \frac{\mathrm{C}}{\mathrm{A}^2}, \quad c = \frac{\mathrm{D}}{\mathrm{A}}.$$

Adhering strictly to the preceding principles, the solution of this equation will stand thus:—

Transposing, $x + cn = n\sqrt{2\,ax+b}$;

$$\therefore\ x^2 + 2\,cnx + c^2n^2 = 2\,an^2x + bn^2;$$

$$\therefore\ x^2 + 2\,n\,(a+c)\,x = bn^2 + c^2n;$$

$$\therefore\ x = an^2 + c + n\sqrt{a^2n^2 + 2\,ac + b} \ldots\ldots (1)$$

$$\text{And } \therefore\ \sqrt{2\,ax+b} = \left\{2\,a^2n^2 + 2\,ac + 2\,an\,(a^2n^2 + 2\,ac + b)^{\frac{1}{2}} + b\right\}^{\frac{1}{2}}$$

$$= an + \sqrt{a^2n^2 + 2\,ac + b} \ldots\ldots\ldots (2)$$

Remembering that $1 + n = 0$, (1) + (2) gives

$$x + \sqrt{2\,ax+b} = c,$$

which verifies the solution (1).

Substituting -1 for n, and making $n^2 = 1$, (1) becomes

$$x = a + c - \sqrt{a^2 + 2\,ac + b} \ldots\ldots\ldots\ldots (3),$$

and therefore, (art. 2,)

$$\sqrt{2\,ax+b} = \left\{2\,a^2 + 2\,ac - 2\,a\sqrt{a^2 + 2\,ac + b} + b\right\}^{\frac{1}{2}}$$

$$= a \backsim \sqrt{a^2 + 2\,ac + b} \ldots\ldots\ldots\ldots\ldots\ldots (4).$$

If $2\,ac + b > 0$, we shall have $\sqrt{a^2 + 2\,ac + b} > a$, and consequently, in this case, (3) + (4) gives

$$x + \sqrt{2\,ax+b} = c,$$

so that, when $2\,ac + b$ is positive, (3) is the solution of (a').

(*To be continued.*)

PAINE'S NEW SOURCE OF LIGHT.

The American newspapers have, for the last twelvemonth and more, teemed with accounts of a very startling but conflicting character, respecting a discovery stated to have been made by a Mr. Paine, of Worcester, of a mode of obtaining, at next to no cost, a light of astonishing brilliancy from the action of electricity on water. The prevailing opinion among our brethren of the transatlantic press seemed to be that the discovery was all moonshine; and so decidedly was this our own impression of the affair, from a perusal of the articles referred to, that we did not transfer a line of them to our pages. We see, however, by the last files of papers received from the United States, that Mr. Paine's supposed discovery has taken fresh hold on the public attention there, and that many who doubted before, are now staunch believers in its reality. We, too, must own that we are a good deal shaken in our incredulity by the additional evidence which these arrivals have brought before us. We can see no more *reason*, indeed, than we did before for the effects alleged to have been produced, which are not

only contrary to all sound philosophy as expounded by the most eminent men of our time, but at variance with common probability; but, on the other hand, we note some remarkably well-attested facts, which are not to be got rid of by merely saying that one does not understand them. We would have these facts further investigated, and (if possible) cleared up; and with this view, we make the following selections from the papers before us.

(*From the Boston Chronotype.*)

What we have seen enables us to say, not only that Mr. Paine has extorted from nature the secret of the artificial production of light at a nominal cost, but that he has got hold of the key which unlocks and enables him to command a new force of nature, which is soon to supersede most of the forces now employed—something which is destined to work a revolution both in science and art.

The operation, as we saw it, was as clear and clinching a demonstration as we ever witnessed in the range of chemical science. There was a rapid and abundant evolution of gas from the water in the jar, with which nothing whatever communicated save two flat strips of copper and the small tube which terminated in the jet or burner, without any possible connection with anything between the jar of water and burner, save the spirits of turpentine contained in another smaller glass jar. The electric apparatus being put in motion, as soon as the air over the water had been expelled, and the exit was closed, the pressure over the water drove the gas rapidly through the spirits of turpentine, and the jet beyond it being lighted, burned freely and with a high illuminating power. A jet attached to the tube between the jar of water and of spirits of turpentine, was lighted, and we saw the unmistakeable form of hydrogen, scarcely visible by daylight. This pure hydrogen was the gas evolved from the water, and could not possibly have come from the turpentine, for the current was all the while flowing from the water *through* the spirits of turpentine—and how could the spirits of turpentine give an illuminating flame on one side and the invisible flame on the other?

Here, then, whatever may be the agency exerted on the water, by or through the flat ribbons of copper, be it something or nothing,—whether we understand it or do not understand it,—water is first converted into hydrogen, or some invisible burning gas, and then, having passed through spirits of turpentine, into a gas of very luminous flame.

So far as the light is concerned, here it is. Mr. Paine produces it somehow, and does it abundantly. There is no rubbing this out, and it is unpardonable in the "scientific men" who must have seen it, that they were unwilling to acknowledge it—that they omitted a portion of the demonstration, and so left the public to infer the power and agency of other causes to account for the effect!

We now come to the question of the cost. Mr. Paine showed us every part of his apparatus, including his peculiar *helices* and *electrode*, not shown to the scientific men before mentioned. We are not at liberty to explain to our readers the peculiarity of their construction; suffice it to say, they elucidated the subject much to our mind, and clothed the discovery with scientific interest superior to its economical and practical.

The means by which Mr. Paine exerts an agency upon the water through the copper ribbons, is a sort of electro-magnetic condenser—an instrument different from those manufactured by the electro-magnetic instrument makers in this city, only in the interior construction of its revolving helices. It consists of two sets of larger permanent, horse-shoe magnets, parallel and opening in the same direction, between the poles of which a pair of helices are made to revolve horizontally. There is no galvanic action in the case, and no expense whatever on these helices but of the slight mechanical force which is necessary to give them a moderately rapid revolution, they meeting no resistance but that of a common pivot and the slight friction of their poles upon metallic discs to effect the successive discharges. But the power of this simple arrangement to evolve electricity is tremendous. The electrical force compared with the mechanical cause, is like that of the rush of water which carries the wheel of a great cotton factory compared with the effort of a child who may hoist the gate. At each discharge of the helices, and there are many in a second, according to the rapidity, an abundant crop of gas bubbles is produced: and this is owing partly to the peculiar construction of the electrode, or form of the poles where presented in proximity to each other in the water of the jar. This electrode is a point of great interest, and it is just at this point that the mighty and mysterious fluid, so potently commanded and propelled by helices, may prove too big for its business, and show its relationship to the favorite weapon of Jove. Here is a stupendous difficulty which has tasked the courage and inventive genius of Mr. Paine—a difficulty of which the public could not be aware, and which seems to account for much delay. He has tamed the

thunder-bolt in this delicate point, at least so far as to insure perfect safety with due care. Other safe-guards may yet be added. However, it is but right to say, that it would not be strange if carelessness and temerity should hereafter meet with a fate here—that will be a caution to them.

The next question is, whether there is any expense of the spirits of turpentine. We certainly could not discover, while we watched it, the slightest waste or diminution. Mr. Paine, and others testify that there is no expenditure of that material. The nature of the luminous flame convinced us that it had gained nothing in quantity, only something in quality, from the spirits of turpentine; and this hypothesis, as any booked-up chemist will admit, is nothing unprecedented. In "Stockhardt's Chemistry," an excellent work, we find the following passage—page 473:—

"Starch, as shown by these experiments, is converted by sulphuric acid, on moderate heating, into gum; on stronger heating, into sugar. In the latter case, also, dextrine is first formed, but this soon passes over into sugar. Accordingly, sulphuric acid exerts two different actions. By the first action, the starch becomes gum (dextrine). By the second action, the dextrine becomes sugar.

"It has not yet been explained how this effect was produced. Starch, starch-gum, and starch-sugar have each the same constitution (isomeric,) so that their difference undoubtedly depends upon a different arrangement of the atoms of carbon, hydrogen, and oxygen contained in them, and it is undoubtedly the sulphuric acid which effects this change in the position of the atoms."

Then, again; after a man has, with his own eyes, seen water converted into hydrogen, and nothing else — unless the oxygen goes off through the solid copper ribbon of the positive pole into a cup of water, and is there drowned without a sign or a bubble—we say, after a man has seen this transformation of water, so unauthorized by the books, it will not be very incredible to him that the spirits of turpentine may change the *quality*—the electrical state —arrangement of particles, or whatever you may suppose it—in the hydrogen, without imparting anything whatever to it. This, we must say, is what we are strongly inclined to believe that it does. On the whole, we feel confident that Mr. Paine has discovered the means of producing an inexpensive light of the purest and most efficient quality, and opened a new and vast field in science. We have seen for ourselves, and find that we have done Mr. Paine very great, though not intentional, injustice. And we can hardly find words to express our surprise at the Scientific Report, which was partly the cause of our doing so. The demonstration which Mr. Paine then presented could not have been of a doubtful character to *chemical* eyes. Those gentlemen must have understood and believed more than they reported."

(*From the Scientific American.*)

The conclusion of the whole matter as reported by Mr. Wright (the Editor of the *Chronotype*) is, first, that Mr. Paine has made a discovery which proves that neither oxygen nor hydrogen are simple substances, and that water is not, as has been supposed, a binary compound of these two gases. Second, that Mr. Paine, decomposed, by negative electricity, the whole of the water in a vessel, and the gas evolved was *pure hydrogen*. Third, that this gas was produced rapidly and cheaply by mechanical power generating electricity. Fourth, that the hydrogen gas was made to produce good white light by passing it through the spirits of turpentine, which catalized the gas without absorbing or consuming the turpentine.

By this we learn, then, that there are no such things as hydrogen and oxygen—that is, as simple distinct substances. We must have more of the why and the wherefore, before we can believe this. The quotation from Stockhart does not satisfy us altogether; there is a difference between the compounds *starch*, *dextrine*, (British gum) and *sugar*, in quantity if not in quality. Starch is composed C 12, H 20, O 20; Grape Sugar (the kind made from starch,) is composed of C 12, H 14, O 14 (carbon, hydrogen, oxygen). It is true, however, that each has the same constitution, and the comparison is clever, but he might have carried it further and stated that the atmosphere and nitric acid had the same constitution. Has the hydrogen, after passing through the turpentine, been analyzed? This is the way to test whether carbon is absorbed by the hydrogen when passing through the turpentine. There is still, no doubt, a vast ocean for exploration before the chemist; but we like chemists who have the spirit of Davy, who never wrapt himself up in mystery, but let the world always know how he was progressing. In respect to the turpentine not being absorbed by the hydrogen, there is collateral testimony in favour of Mr. Paine, and there is also testimony against him. If water can be all resolved into hydrogen, surely hydrogen can be resolved into water. Now it is well known that it requires hydrogen and oxygen, and a third substance to produce water. Hydrogen and oxygen will remain as distinct gases, in one jar, for any length of time, without forming water, and not until a piece of platinum, or the electric spark, performs the

marriage ceremony, will unite chemically to form water. This wants to be cleared up in the case of Mr. Paine's discovery. These things should be treated fairly, and good reasons given. Hitherto water never has been decomposed by a single pole of a battery, and those who believe it cannot be done, are entitled to the greatest confidence, until it is publicly demonstrated to the contrary.

Letter from Mr. G. Mathiot, of the United States' Mint, to the "Scientific American."

Messrs. Editors.—I have passed hydrogen through turpentine and found it to acquire high illuminating properties. You know there is an old experiment of the "philosophical candle," made by generating hydrogen under a stratum of turpentine; but thinking the newly-generated or nascent hydrogen might have the power of decomposing or absorbing the turpentine, I led the hydrogen from the generating bottle by a bent tube dipping under the turpentine in a separate bottle. The light was very brilliant; in intensity, I thought between the Drummond light and the solar lamp; a spirit gas-light looked dingy alongside of it —as ordinary lights appear by the lime light. The taking of a Daguerreotype by it would have been very easy.

I next directed my attention to ascertain the quantity of turpentine used along with a known quantity of hydrogen. I first accurately measured a portion of turpentine, and then passed the gas from 33 ounces of zinc through it, burning the gas at the jet all the time. I then again measured the turpentine, and found it not perceptibly less than before. Now, in this case the hydrogen could not have been changed into carburetted hydrogen, for coal gas contains from four to five times as much carbon as hydrogen, and pure carburetted hydrogen has six times as much carbon as hydrogen; and as 33 ounces of zinc, by solution, liberate 1 ounce, or 12 cubic feet of hydrogen, therefore from four to six ounces of turpentine should have been used up, supposing it to be all carbon; but turpentine is composed of twenty atoms of carbon to fifteen atoms of hydrogen, and consequently only one-seventh of its carbon can be taken up by the hydrogen; or in other words, 42 ounces of turpentine will be required to carburet one ounce of hydrogen. Yet still thinking that some portion of the turpentine might be evaporated, I cooled the bottle with the turpentine, and placed the whole apparatus in a cold bath, and tried the experiment over again, but the light was the same. I then heated the turpentine to 120°, and then passed the hydrogen through it, but the light was the same. I then took a half-gallon tincture bottle, and put in nearly three pints of cold water and three-quartery of a pint of turpentine, and let the pipe from the hydrogen generator run quite to the bottom of the water—the light appearing the same, or a little better. I have used the same lot of turpentine in all these experiments, having had a brilliant light for about three hours: and the turpentine, though frequently poured from one bottle to another, is not a teaspoonful less than before I began the first experiment.

I have now announced to you the simple facts of the matter, the *rationale* I leave to the scientific world. The next step, after ascertaining that hydrogen can be used for illumination, is, whether the light is according to its weight or its bulk, as compared with coal gas—that is, within 200 cubic feet of this catalyzed hydrogen will go as far for light as 200 feet of coal gas, or whether it will require 200 feet—one pound of the hydrogen to do the work of 26 feet — one pound of coal gas.—Very truly yours, &c.,

George Mathiot.

A patent has been taken out in this country by parties in the interest of Mr. Paine, and we learn from them that in a week or two we shall have an opportunity of witnessing in London a practical demonstration of the truth of his discovery.

DIAGONAL BRACING IN SHIP-BUILDING—THE INVENTION, NOT OF SIR ROBERT SEPPINGS, BUT SIR SAMUEL BENTHAM.

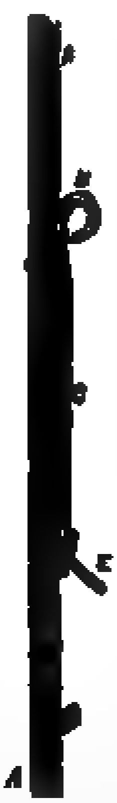
In last Saturday's Magazine, No. 1432, page 51, column 2, there is an omission, line 13, which gives a meaning to the sentence the reverse of truth, since, as the phrase stands, it implies that Sir Samuel Bentham's experimental vessels were, at their first construction, weak, when in point of fact they, from the very first, exhibited tokens of unprecedented strength, and no alteration of structure was ever made in any of them. The latter part of the sentence in question was intended to have been as follows;—"and also between the pillars in other parts of his vessels, which theretofore *in those of the usual construction* had exhibited signs of excessive weakness."

Since that Number of the Magazine went to press, it has been ascertained that Sir Robert Seppings did not employ diagonal trussing till the year 1810, fourteen years *after* most of Sir Samuel's vessels were at sea. It was in the repair of the *Tremendous* that Sir R. Seppings first adopted them, long after Sir Samuel's vessels had repeatedly come into our several ports for supplies, and

sometimes for repairs of damages received in brilliant actions with the enemy. One of those vessels particularly—the *Dart*—after seven years' service, in which she had much distinguished herself, underwent, by order of the Admiralty, in 1803, a very particular examination, which was reported on by the Surveyor of the Navy and the shipwright officers of Deptford Dockyard, each of them making his *individual* report. In these reports, "in all cases where *particulars* were entered into, the superiority of this vessel in point of strength over vessels of the long-approved construction, was expressed in strong and convincing terms," so that it can scarcely be doubted but that Sir Robert Seppings must have been aware that, in ship-building, diagonal trusses and braces had been first introduced, not by him, but by Sir Samuel Bentham.

CAPTAIN JERNINGHAM'S REGISTERED LETTER CLIP.

Fig. 1. Fig. 2.



The above engravings represent a very neat, useful, and cheap contrivance, for the use of public offices, counting-houses, &c. It ought indeed to be an appendage of every writing-table or desk. Fig. 1 is a front, and fig. 2 a side elevation of this clip. AA is a back piece, in which there is a hole B, by which the article may be suspended; CC is a spring-holder, which is composed of a single piece of wire, bent into a horizontal form, which lays flat against the back piece, and is attached to it by its two ends. The two ends are twisted into a series of coils DD, as shown, which have the effect of causing the holder to press with force against the back-piece. E is a loop by which the string-holder is raised, in order to introduce the letters or other papers to be secured.

ON CERTAIN PHENOMENA OF FORCED DILATION OF LIQUIDS. BY M. MARCELIN BERTHEOLET.

If a somewhat strong capillary tube, closed at one end and drawn out at the other to a slender point, is filled with water at the temperature of 28° or 30° cent.; if this tube is cooled down to 18°, so as to cause a certain quantity of air to enter it at the open point, and it is then closed, and again heated to 28° and gradually higher, after a certain time the air is completely dissolved. If cooled to 18°, the original temperature at which the tube contained at the same time gas and liquid, it is seen that the water continues to occupy the whole of the internal capacity, and maintains thus an invariable density between 28° to 18°. Its temperature may even be lowered still more. At this moment the least shock or collision, the least variation, causes the instant reappearance, with a sort of ebullition, a slight noise, and a shock more or less perceptible, of the gas dissolved in the water. It dilates rapidly, and in less than a second has resumed its primitive volume at 18°. I have made the same observations with the following liquids, selected from all classes: water, solutions of various salts and gases, solution of soda, various acids, alcohol, ether, acetone, Dutch liquid, essence of turpentine, oil of olives, kreosote, sulphuret of carbon, chlorides of metalloids and metals, bromine. Mercury is the only liquid with which I have not succeeded, either in the presence of the air or *in vacuo*. A bubble of air remained several days in presence of the mercury without dissolving, at least completely, and that under pressures of 200 to 300 atmospheres, produced by preventing for that length of time the dilatation of the mercury due otherwise to an increased temperature of 8° to 10°.

In these phenomena there are two things very distinct. 1. An unstable supersaturation of the liquid by the gas, produced under the influence of the pressure. There are numerous examples of this order of facts. 2. A state of forced dilatation of the liquid; the latter, in fact, an instant before the vibration, fills the volume which the gas occupies an instant after conjointly with it, and this volume is the same which the dilated liquid filled on an elevation of tempe-

rature of 8° to 10° and more. The variation of density thus produced is enormous; for water it is equal to $\frac{1}{450}$th of its volume at 18°; for alcohol to $\frac{1}{93}$, for ether to $\frac{1}{58}$. Such an effect would be produced in an opposite direction only by a pressure of 50 atmospheres for water, of 150 for ether. This phenomenon is very general, and is proved by the variety of the liquids on which I have operated. It probably accompanies all supersaturations, but at variable degrees and in various directions, without being capable of being proved.

Following the advice of M. Regnault, I endeavoured to separate the two facts, and to produce the dilatation of the liquids *in vacuo*. A peculiar apparatus enabled me to fill the tubes with liquids absolutely freed from air, and to close them without letting any gas enter. Under these new conditions, I reproduced the phenomenon of forced dilatation with water and ether, and have thus seen that it is independent of supersaturation. This permanence of the density of the liquids in an interval of temperature, more or less considerable, appears to me attributable to the adhesion of the glass and the liquid; it is a force which is opposed to the division of this latter; and which can only be destroyed by an increase of the molecular attraction of the liquid for itself, an increase produced under the influence of cooling.—*Comptes Rendus*, June 24, 1850.

PHOTOGRAPHY. — MODE OF OBTAINING GLASS NEGATIVES. BY MR. T. A. MALONE.

In repeating the experiment of M. Niepce de Saint-Victor on photography on albumen (published in the *Technologiste* for 1848), I was led to devise a plan of my own for making "glass negatives." I proceeded as follows:—To the white of an egg its own bulk of water was added; the mixture beaten into a froth was then put into a strainer made of letter paper so twisted as to form a cone, having a small aperture at its apex; pinned near the base to hold the paper to its shape. The clear diluted albumen soon pass through into a wide-mouthed bottle, which answers the double purpose of a receptacle for the fluid and a support to the cone. A piece of plate-glass, thick or thin, as you please, was then rubbed with a solution of caustic alkali, washed in water, and dried in a cloth: just before applying the albumen, the glass was breathed upon and rubbed with new blotting-paper; then, to remove dust and fibres, cotton wool was used. Unless this latter and every other precaution is taken to prevent dust, the picture will be full of spots, produced by a greater absorption of iodine (in a subsequent process) in those than in the surrounding parts.

Now pour the albumen on the glass, inclining the plate from side to side until it is covered; allow the excess to run off at one of the corners, keeping the plate inclined nearly vertical. As soon as the albumen ceases to drop rapidly, breathe on, or warm the lower half of the plate; the warmth and moisture of the breath will soon cause it to part with more of its albumen; wiping the edges constantly hastens the operation.

Until this plan was adopted, the coatings were seldom uniform; the upper half of the plate retained less albumen than the lower, —of course care must be taken to warm only the lower half. When no more albumen runs down, dry the plate. I use for this purpose a double-ring gas-burner of some eighty jets. A common fire answers as well, save now and then it imparts a little dust.

The film, when dry, is quite free from cracks, and is so thin and transparent that the brilliancy of the glass is unimpaired. It is almost necessary to mark it to know which side has been coated.

The next operation is to iodise the plate. Dilute pure iodine with dry white sand in a mortar, using about equal parts of each. Put this mixture into a square glass trough, and over it place the albumined plate; as soon as the latter has become yellow in colour, resembling beautiful stained glass, remove it into a room lighted only by a candle, or through any yellow translucent substance—yellow calico, for instance. Here plunge it vertically and rapidly into a deep narrow vessel containing a solution of "aceto-nitrate" of silver, made by adding three ounces of nitrate of silver to two ounces of glacial acetic acid, diluted with sixty ounces of distilled water. Allow it to remain until the transparent yellow tint disappears, to be succeeded by a milky-looking film of iodide of silver. Washing with distilled water completes this operation. The plate is now ready for the camera. After it has been submitted to the action of the light, pour over its surface a saturated solution of gallic acid. A negative Talbotype image on albumen is the result. Washing with water before and after immersion, in a solution of one part of hyposulphite of soda in sixteen parts of water, until the yellow tint is removed from the shadows, completes the process.

But where is the novelty? Let us go back a step. While the gallic acid is developing its reddish-brown image, pour upon the surface a strong solution of nitrate of silver: the brown image deepens

in intensity until it becomes black. Another change commences: the image begins to grow lighter, and, by perfectly natural magic, finishes by converting the black into white, presenting the curious phenomenon of the conversion of a Talbotype *negative* into, apparently, a Daguerreotype *positive*, but by very opposite agency, no mercury being present; — metallic silver (probably) here producing the lights, while in the Daguerreotype it produces the shades of the picture. I have said probably, because it may be unwise to speculate chemically upon appearances which may depend solely on molecular arrangement—an intricate subject, to which I hope this communication may prove a slight contribution.

Professor Wheatstone has suggested to me the desirableness of substituting blackened wood or blackened ivory for glass plates; we should probably then have the novelty of a Daguerreotype on wood free from some of the disadvantages attendant on polished metal. Mr. Cundall suggests the application of it to wood blocks for wood engravers for certain purposes, making the drawings by light instead of by hand.

I am, &c.,
T. A. Malone.

Athenæum.

NIAGARA SUSPENSION BRIDGE.

Having seen several attempts at a description of the suspension bridge, and all more or less erroneous, I trust I shall be pardoned for a brief sketch relating to the said work as it now stands, being merely a temporary structure as compared with the original design. Early in the spring of 1847, while at dinner at the Eagle Hotel, in the village of Niagara Falls, there were present C. Elet, jun., the engineer of the bridge, the writer, and several other gentlemen, when the subject came up how the first wire was to be got over the river. One proposed the steam-boat, another a small boat to take a line across, another would throw a bombshell over with a cord attached to it, and severally other equally practicable projects were advanced, when Mr. Elet himself suggessed the use of a rocket, by which he expected to throw his first line across the Gulf. This seeming to be the end of propositions, Mr. Fisk, of your city, addressing Mr. Elet, said, "With your leave, and a promise not to ridicule the idea if it should prove a failure, I will, in a more simple and cheaper mode, attempt to get a line across the Gulf." This being agreed to, those present desired to know what method he should pursue to get a line across. "Well, gentlemen, I have not the least objection to tell you all about it, provided you adhere to the promised conditions, not to laugh at me. Now, gentlemen," said Mr. Fisk, "my plan and the instrument used will be the same kind used by Franklin to draw lightning from the clouds—an instrument that any ingenious schoolboy can make in an hour—a kite." Mr. Elet remarked that he did not see why it would not succeed, and gave his consent to have it tried. Mr. Fisk then called upon an intelligent boy by the name of Walsh, who soon had a kite constructed, and on the second trial threw a line across; making it fast on the opposite side, by doubling which a small rope was drawn over, and in six or seven doubles, strength sufficient was acquired to take over the first small cable of 36 wires. This was the one used to pass Mr. Elet over in his little iron car, and next himself and his lady, and many other persons, passed over on this slight fixture; since which the present structure has been reared, resting on wooden towers 50 ft. high, over which pass 14 cables, of the following dimensions—viz.: Five of 36 wires each, five of 72, one of 125, and three of 150 wires—1115 wires in all. To these is the bridge suspended, and is capable of sustaining a weight of nearly 1000 tons, yet so light in its appearance to strangers, that some will not pass it, through fear of its instability, yet heavy teams pass it. Five at one time were on it, of Col. Mann's Circus; besides which many droves of fat cattle have passed it. It is now perfectly safe as a common thoroughfare, but will all give way to one of the grandest structures in the world, as soon as it is required for railway purposes, for which, from the exertions now being used by the directors and people on both sides, it seems likely to be required within a year or two. The railroad structure will require 16 cables of 6000 wires each, all laid straight—not twisted, as some have it—but wound with small wire, and when completed, with its massive stone towers, will sustain a weight of more than 6000 tons beyond its own weight, a structure worthy, as one of art, to stand by the side of Nature's grandest—the Falls of Niagara. For this and other improvements, contemplated or finished, are the public indebted to the Hon. Charles B. Stuart.—*Rochester* (*U.S.*) *Daily Advertiser.*

PATENT-LAW PRACTICE.—NEW ORDERS.

"The Attorney-General, with the consent and concurrence of the Solicitor-General, hereby gives notice that from and after the 15th day of Jan., 1851—1. Every outline, description, and drawing de-

posited with the Attorney and Solicitor-General must be signed and dated by the person applying for the patent, or his agent. 2. Every person who shall have deposited an outline, description, or drawing of his invention shall be at liberty at any time previously to the enrolment of the specification, to cancel any portion of such outline, description, or drawing; and for this purpose to deposit a fresh outline, description, or drawing of his invention, omitting the cancelled parts. 3. Every person who shall have entered a caveat against the granting of any patent, and shall, upon the hearing of his opposition, induce the Attorney or Solicitor-General not to make any report upon the application for the patent, shall deposit with the Attorney or Solicitor-General an outline, description, or drawing of his invention in respect of which he opposes the granting of the said patent; such outline, description, or drawing to be approved of by the Attorney or Solicitor-General. 4. After the specification shall have been enrolled, any person shall be at liberty, on production of a certificate of the enrolment, or after two days' notice, and payment of one shilling, to inspect the outline, description, or drawing so deposited with the Attorney or Solicitor-General as aforesaid, of the invention in respect of which the specification shall have been so enrolled, as aforesaid, and any person shall be at liberty to obtain an office copy of such outline description from the office of the Attorney or Solicitor-General, on payment of the accustomed charges.—(Signed) John Romilly."

With the opinions which we entertain, and have before expressed (see last vol., p. 371), on the subject of Deposit and Provisional Specifications, we cannot profess to entertain any surprise at the issue of these new orders. At the same time, we regard the issuing of them with regret, for we foresee many practical evils that will inevitably result from them.

The position which we contended for was that as long as it was the practice to allow a patentee six months to prepare and file his specification, and that it was the declared law of the land, that a patentee was bound to give the public, at the end of six months, the full benefit of his invention, as it *then* existed in his mind—not as it stood at the beginning of the probational period, but in its state of full maturity, after six months reflecting, and perhaps experimenting upon it—that as long as such was the law and practice, it was not competent to the Attorney or Solicitor-General to tie an inventor down, by any outline specification which he might require him to deposit, from doing his utmost to improve his invention during the six months, or from including in his ultimate specification whatever improvement he might make in the interim. Sir John Romilly appears to have felt the force of these considerations, and hence these new orders which amount practically to the *doing away with deposit specifications altogether*. For, if a person may, before enrolling his final specification, withdraw any written specification which he may have deposited, on applying for his patent, and substitute any other he pleases, who will be so foolish as to leave anything standing against him which can operate to his prejudice? And if deposit specifications are to be no check against unfair after-appropriations, of what use will they be at all? None whatever. People knowing that they go for nothing, will pay no heed to what they put into them, and a degree of laxity will arise in the disposal of disputed cases of priority of invention, far exceeding anything that has ever yet been experienced.

The provision (Rule 3) which requires a written statement of all objections to the grant of a patent to be lodged, is useless. Suppose this to be done. What then? Who is to be bound by it? And if anyone, to what extent? Take the case of a patent disputed on the ground of want of novelty by C; will it be any answer to him to say, that the same objection was taken to it by another party, B, at the time of the patent being applied for, and overruled? By whom overruled? The Attorney or Solicitor-General?—a decision by neither of whom is of any authority in courts of law? And after what sort of trial? A hearing of the parties out of the presence (as is usually the case) of one another; and at which no verification of the statements of either party by legal evidence is practicable.

The real remedy for the difficulties aimed at by the present Rules is, to do away with the probationary period of six months altogether, as proposed by the Patentees' Association (see *ante* p. 10), and to cause the specification to be filed at once on the granting of the patent, *which is the practice in every country except our own.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JANUARY 22, 1851.

John Silvester, of West Bromwich, Stafford, whitesmith. *For improvements in straightening, flattening, setting, and shaping hardened steel.* Patent dated July 17, 1850.

Specification. Many articles formed of steel, such as saw-blades, become spoiled by their being warped in the process of hardening,

and have either to be hammered into form, or softened and re-hardened; and in some cases they are so damaged, that they have to be altogether thrown aside. Now my invention consists in straightening, flattening, setting, and shaping such plates as may be warped in the process of hardening by placing and pressing them between dies previous to, or while they are being "brought back" by tempering. Fig. 1 is a side elevation, and fig. 2 an end elevation of a machine by which this is effected. A A is a strong metal frame,

Fig. 1.

Fig. 2.

Fig. 3.

which is mounted on a basement plate B, to which it is firmly connected. C is a carriage which carries dies, D D, between which the steel plates to be straightened, flattened, or set, are placed. The plates are inserted between the dies, and the carriage is then run in underneath the frame A, or the plates may be put between the dies after the carriage is in its place beneath the frame. Then by means of the screw E, and hand-wheel F, the dies are compressed or forced together, so as to bring them to bear uniformly upon the plate or other article between them. The dies being thus compressed are next bound together by means of clamps, and the pressure of the screw E removed, so as to leave the carriage C free to be removed, and pushed into the furnace, in order that the plate may be heated to the temperature requisite to "bring back" the article to the proper temper. The carriage C runs upon rails G G, by which means it is more readily moved and put into the furnace, and into its position under the frame A. H H is a frame or beam which is slid underneath the lower die, while the dies are being brought together by the action of the screw in order that this bar may relieve the pressure from the axles of the carriage.

The upper die can be raised by means of the screw, and the introduction of the sliding-frame H^2, to such an extent, as to admit of the plates being either removed or introduced at pleasure.

Sometimes instead of running the carriage with the articles to be tempered into the furnace, the dies themselves are previously heated to such a degree as to "bring back" the hardness of the steel to the requisite temper. In this case the upper die is raised by means of the sliding frame H^2, and the article introduced when the pressure requisite to straighten, flatten, set, or shape, the plate is produced by the screw E, and hand-wheel F, as before. Fig. 3 is a cross-section of a pair of dies, for straightening, flattening, setting, and shaping, and tempering thin steel plates, on which the weight of the upper die may be sufficient for producing the requisite pressure without the assistance of a screw or other press. A is the lower die; B the upper one; C a lever which is jointed to the upper die by means of a pin D; the other end of the lever is jointed to some fixed point as at E. These dies may be heated previous to the blade or other article to be tempered being laid between them, as in the method of tempering last before explained, or the whole may be heated together in the furnace.

I also temper blades, plates, and other hardened articles made of steel, by immersing them in a bath of molten lead or other metal, and while the articles are thus being tempered, they are flattened and set by being placed between dies which are perforated all over with numerous holes, so as to allow the molten metal to speedily communicate the requisite temperature to the articles placed between them. It is necessary that the dies should be bound together by means of clamps, both for the purpose of holding the dies and producing the pressure upon the article.

Sometimes instead of "bringing back" the plates and other articles of hardened steel to the proper temper by means of the heat of the furnace, I employ perforated dies, into the hollows or cavities of which molten lead or other metal is poured, so as to raise the temperature of the dies sufficiently for giving the requisite temper to the hardened steel article placed between them.

And having now described my said invention, and the manner in which the same is to be performed, I declare that what I claim is the straightening, flattening, setting and shaping of plates and other articles of hardened steel by mechanical pressure previous to or while they are in the course of being tempered, the pressure being continued during the process of tempering, as before exemplified and described.

EDWARD N. SMITH, of West Brookfield, Massachusetts, United States of America. *For a machine to fold paper.* Patent dated July 17, 1850.

Claims.—"I claim an automatic mechanical combination, composed of elements which, by their operation together, strike the sheet of paper on a line in which the fold is to be made, and double the paper together, and complete the folding of it, the said elements being as follows:—First, that for striking the sheet at its middle or other proper part where the fold is to be made, and advancing it towards or between the folding surfaces. Second, machinery to further move the paper, and between the surfaces which fold it; and, Thirdly or lastly, Folding surfaces or mechanism which complete the folding; the whole being constructed and made to operate essentially as specified, or in any other manner, while they preserve the principle of folding a sheet as described,—meaning also to claim an automatic mechanical combination of two or more such collections or combinations for the purpose of successively folding a sheet with two or more folds, substantially as hereinbefore specified. I would also remark, that I lay no claim to the naked and well-known principle of folding a sheet of paper by a person crowding or pushing it by a thin blade or plate between two surfaces; my invention embodying such surfaces and contrivances with mechanism for operating them, and which surfaces, contrivance, and mechanism, as a whole, become an automatic machine capable of performing the work of folding a sheet of paper to great practical advantage."

WILLIAM HERBERT GOSSAGE, of Stoke Prior, Worcester, chemist. *For improvements in obtaining certain metals from some compounds containing such metals, and in obtaining other products by the use of certain compounds containing metals.* Patent dated July 17, 1850.

Claims.—1. Obtaining copper and silver, or one of these metals, also sulphate of soda and hydrochloric acid, by the use of the material designated "burnt pyrites," firstly, by fluxing this material with alkali waste, so as to obtain metals in a state of regulus, which is used for decomposing common salt, and thereby obtaining sulphate of soda and hydrochloric acid, at the same time that the copper and silver, when contained in such regulus, are brought to a state capable of solution by water, from which solution these metals, or one of them, can be precipitated in a metallic state, or in the state of oxides and chlorides, which can be easily reduced to the metallic state by many known means; secondly, by mixing such burnt pyrites with common salt and small coal, and subjecting the mixture to the action of sulphurous acid gas, thereby obtaining sulphate of soda and hydrochloric acid at the same time that the

copper and silver, when contained in such burnt pyrites, are brought to a state capable of solution by water, from which solution these metals, or one of them, can be precipitated in a metallic state, or in the state of oxides or chlorides, which may be afterwards reduced to the metallic state.

2. Obtaining sulphate of soda and hydrochloric acid from native pyrites, burnt pyrites, and small coal, by making this mixture into balls, which are burnt in kilns, and sulphate of soda and hydrochloric acid produced, at the same time that the copper and silver are brought to a state capable of solution by water, from which solution these metals, or one of them, can be precipitated in a metallic state, or in the state of oxides or chlorides, which may be afterwards reduced to the metallic state.

3. Obtaining sulphate of soda and silver from the regulus of copper and of iron containing silver, by mixing the regulus with common salt and small coal, and making this mixture into balls, which are burnt in kilns, thereby obtaining sulphate of soda, oxide of iron, and a portion of the silver in a soluble state; also extracting the remaining portion of the silver by subjecting the residuum (after lixiviation) to heat, in mixture with coal, thereby converting the oxide of iron to a metallic state, the metallic iron thus obtained being subsequently caused to decompose galena; or, extracting the remaining portion of the silver by subjecting the residuum (after lixiviation) to the action of hydrochloric acid, by which the silver will be obtained in a state of solution, from which solution it may be precipitated in a metallic state, or in the state of oxide or chloride, which can be easily reduced to the metallic state.

HENRIETTA BROWN, of Long-lane, Bermondsey, widow and executrix of the late Samuel Brown. *For improvements in the manufacture of metallic casks and vessels.* (A communication.) Patent dated July 17, 1850.

The present improvements consist in securing the heads of metallic casks, and the bottoms of cans or other vessels, and in making joints in such casks and vessels by bringing the meeting or overlapping parts under the operation of suitably formed rollers by which the two thicknesses of metal are corrugated together. The ridge of the one corrugation fits into the concavity of the other, and thus not only is the use of rivets dispensed with, but additional strength imparted to the portion of the casks or vessels so treated. When the joint is required to be fluid-tight, it must be soldered in the usual manner. One corrugation only is shown and described in the specification, but the patentee remarks that a greater number may, of course, if desired, be made use of.

Claim.—Causing the heads of casks and bottoms of vessels to be secured, and parts of iron vessels to be joined by corrugating the two thicknesses of metal.

EDWARD JOHN DENT, of the Strand, chronometer-maker. *For improvements in compasses for navigation, surveying, and similar purposes.* Patent dated July 17, 1850.

Mr. Dent's improvements consist, 1. In suspending the needles of compasses so as to prevent oscillation; and 2. In the adaptation to prismatic compasses of a telescope, by which the focus of the eye may be adjusted to objects at different distances, and the instrument adapted to the sight of different operators. In respect of these improvements he claims: 1. A mode of suspending the needle of a compass by means of gimbals upon an axis moving in pivot-holes or centres, to which axis the card is fixed, or upon a tube or frame mounted on a fixed pin, and carrying the card, as described; the employment of rings of glass, porcelain, agate, or other hard stone, for the lower bearing or guide of compasses mounted on a fixed pin, and the application to compasses of a spring or break to act on the vertical axis and create "sluggishness."

2. The application to a compass of a telescope in combination with a prism, as described.

HENRY BESSEMER, C.E. *For certain improvements in figuring and ornamenting surfaces; and in the blocks, plates, rollers, implements, and machinery employed therein.* Patent dated July 21, 1850.

Claims.—1. A method of doing over engraved blocks or plates with bronze or other dry powder, and then pressing the same in a heated state upon the surface to be figured or ornamented; the latter having been previously coated for the purpose with a preparation which the heat renders adhesive.

2. A mode of using two blocks for producing bright metallic impressions on book-covers and other surfaces.

3. A mode of ornamenting woven fabrics by placing them in contact with some other fabric which is moistened all over with adhesive matter, and which, on pressure being applied, supplies the parts pressed with as much moisture as will cause the metallic powders to adhere.

4. The admixture of gum resins with bronze powders, to be used in a dry state for ornamenting and figuring surfaces.

5. A new composition for edging (*quasi* gilding) books and papers, formed of gamboge and bronze powder.

6. The forming of blocks, plates, or rollers for impressing designs on book-covers, &c., of malleable cast iron. And

7. A peculiar method of manipulating with bronze powder in figuring and ornamenting surfaces.

We shall give full details of these processes in our next.

THOMAS MILLS, of Bow, engineer. *For improvements in steam engines and in pumps.* Patent dated July 22, 1850.

Claim.—The constructing of pistons for steam engines and pumps with an expanding ring, acted upon by a wedge-shaped piece acting parallel to the line of motion.

A very ingenious method of construction, of which we shall give a full description, with engravings, next week.

JAMES BRADFORD, of Torquay, jeweller. *For improvements in locks and other fastenings.* Patent dated July 22, 1850.

Mr. Bradford's improvements in "locks" consist in the addition to them of certain spring bolts or catches which take into the tumbler or bolt at certain points, and make it impossible afterwards to pick the lock. The improvements in fastenings have reference to broaches and other similar articles.

Specification Due, but not Enrolled.

JEAN JULES VARILLAT, of Rouen, France, manufacturing chemist. *For improvements in the extraction and preparation of colouring, tanning, and saccharine matters from various vegetable substances, and in the apparatus to be employed therein.* Patent dated July 17, 1850.

RECENT AMERICAN PATENTS.

(Selected from the *Franklin Journal.*)

FOR A COMPOUND FOR IMPARTING A GLOSS TO CLOTHES. *William D. Beaumont.*

The nature of this composition, or compound, consists in the use of stearic acid, white wax, oil of sassafras, and spermaceti, combined in such quantities, and dissolved by gradual heat, so as to produce, when cooled, a polish, in the form of cakes or bars, to be used with the ordinary starch, in small quantities, which has the effect of imparting to the shirts, linens and other fabrics thus starched a beautiful gloss, and smooth surface, similar to that produced by the process of sizing and ironing linens in the roll, and also prevents the said iron from adherring thereto when ironing the same, and also prevents the dust floating in the atmosphere from sticking to the linens after ironed for use.

Claim.—"What I claim as my invention, is the within described compound of stearic acid, white wax, spermaceti, and quick lime, prepared as fully set forth."

FOR AN IMPROVEMENT IN PRINTING MACHINES. *John B. Fairbank.*

"The nature of this invention consists in arranging within a suitable case a series of sets of inclined wires or rods, attached to bent plates at their upper ends, upon which rest keys. The keys, plates, and wires being supported by coiled springs, each set of wires being brought within a small compass at the bottom, and having type upon their lower ends, marked with characters indicating letters, and sounds of letters, and capable of being inked and pressed against a sheet of paper, either singly or in connection with others—by pressing on the said keys. The keys working changes upon the type. I use in our machine forty-eight entire and separate alphabets. Each of which comprises a vowel and a consonant alphabet, separate and distinct from each other. In writing, I use a vowel alphabet for every vowel character printed in a line upon the paper, and a consonant alphabet for every consonant character in one line. Each vowel alphabet has fifteen keys, and their attachments by which changes are wrought upon five wires, and their attached type, to make either of the fifteen vowel characters. And each consonant alphabet has twenty keys and their attachments, working changes upon six wires or type for making either of the consonant characters used.

"In writing, letters or sounds indicated by characters, are selected from the various alphabets—one letter from each. The characters upon the keys taken expressing the sounds of the words written, observing to select the alphabets in the order in which the sets of type (the five and six type forming one set) are arranged above the paper (one-eighth of an inch from it.) At the end of every line written, the ink-roller is forced under the type, and the paper-carriage moved by the foot or hand."

Claim.—"What I claim as my invention, is the mode of representing letters, and the sounds of letters, by means of characters made by changes wrought upon a less number of moveable type than the number of letters or sounds of letters represented. The type being made upon, or attached to the bottom of wires or rods which are worked by keys, at or near the top, substantially as herein set forth."

FOR AN IMPROVED ROADWAY FOR RAIL-CARS AND ORDINARY VEHICLES. *Jordan L. Mott.*

"The nature of my invention consists in making the rails each with a curved or trough-like projection outward and downward from the upper and outer edge of the

rail, and in combination therewith, to the level of the edge of which projections the roadway is to be paved; the said projections of the rail being a gradual curve or inclined plane from the upper edge of the rail, that the wheels of common carriages may pass over the rail with facility, and when running thereon, may have a tendency, by reason of the inclined or curved face, and the weight of the carriage to descend from the rail; and thus, at the same time, keep the other from the inner edge of the other rail, if the gauge of the carriage be the same, or nearly the same, as that of the rails; and if it be of a wide gauge that the two wheels in running thereon may straddle the rails, and run on the outside of both.

"My invention also consists in making the inner edge of the rail with an inclined or trough-like projection, in combination with the above mode of making the projection on the outer edge."

Claim.—"What I claim as my invention, is the method substantially as herein described, of making rails for the roadways of streets, &c., by combining with the rails on which flanched car-wheels run, outer faces of sufficient breadth for the wheels of common carriages to run, made curved or inclined from the top of the rail, substantially as described.

"And in combination therewith, I also claim making wide faces on the inside of the rails, substantially as described, for the wheels of common carriages to run on, as described."

FOR AN IMPROVEMENT IN MACHINES FOR MAKING ROPES. *Henry Evans.*

"My invention consists in supporting the frame and gears of the strand spindles on the main laying shaft alone, and combining with the said frame and the main frame of the machine suitable machinery, whereby the said frame of the gears and strand spindles may be either clamped to the main frame, or so fastened as to be prevented from revolving, while the main laying shaft and strand spindles are in revolution on their respective axes, or be unclamped or unfastened as occasion may require, and for the purpose of enabling the strand to be laid or twisted together, without previous removal from their spindles, as will be hereinafter more particularly explained."

Claim.—"What I claim as my improvement, is to support the frame of the gears and strand spindles on the main laying shaft alone, and combining with the said frame and the main frame of the machine the lever or suitable machinery whereby the said frame of the gears and strand spindles may be either clamped to the main frame, or so fastened as to be prevented from revolving, while the main laying shaft and strand spindles are in revolution on their respective axes, or be unclamped or unfastened therefrom as occasion may require, and for the purpose of enabling the strands to be laid or twisted together without previous removal from their spindles, as heretofore practised and above described."

FOR IMPROVEMENTS IN MACHINERY FOR FULLING CLOTH. *Charles A. Read and Thomas Cotter.*

"The nature of our invention consists in fulling fabrics by means of toothed cylinders operated by power machinery."

Claim.—"What we claim as our invention is the above-described mode of fulling fabrics by means of toothed cylinders by power machinery, the fabric being fed between the fulling toothed cylinders by means of feeding rollers, through guides, with sufficient rapidity to prevent all strain upon the fabric, and at the same time to supply the fulling cylinders which receive the fabric, full it, and then pass it out between two cleaning rollers, which receive it from the fulling cylinders prepared for other processes. The movements of the several partt of the machine being produced by a combination and adjustment of mechanism similar to that herein described, or any other which may be substantially the same, and by which analogous results may be produced."

India-rubber Gas-holders.—Mr. J. L. Hancock has just completed four portable gas-holders destined for the city of Mexico, which are in several respects worthy of notice. As no workmen are to be found in the capital of Montezuma capable of putting an ordinary sheet-iron gas-holder together, and as the cost of sending out competent men from this country for such a purpose would have amounted to a large sum, it was suggested that a substitute for iron might be found in canvas rendered impermeable to gas by India rubber, and Mr. Hancock's experience was called in to aid the carrying out of the suggestion. The vessels made by him are cylindrical bags, 12 feet diameter, and 15 high, formed of a double thickness of strong canvas, stuck together with a solution of India rubber. Rings of three-eighths of an inch round iron are introduced in the sides at intervals of about a foot, so as to keep them in their circular shape, and the whole when packed represents a disc of 12 feet in diameter, by a few inches in thickness, in which form they are intended to be transported to their destination. The cost of each gas-holder complete is 55*l.*, or about 8d. for each cubic foot of its contents,—a sum considerably less than the cost of a tank and gas-holder of this dimension, and of the usual construction, in this country.—*Journal of Gas-Lighting.*

Jenny Linds.—In the Catalogue of the last Exhibition of American Manufactures, Philadelphia, there are the following items, "Jenny Lind patent leather stitched welts, and ladies' quilted cork sole stitched gaiters" (obtained a first premium), "Jenny Lind riding boots," and "Jenny Lind halters!"

WEEKLY LIST OF NEW ENGLISH PATENTS.

Richard Bycroft, of Paradise Wolsoken, Norfolk, gentleman, for improvements in apparatus to be used by persons to secure warmth and dryness when travelling. January 18; six months.

George Normard, of Shoreditch, Middlesex, cabinet-maker, for an improved cooking and boiling apparatus. January 18; six months.

George Frederick Munty, junior, for improvements in furnaces applicable to the melting of metals for making brass, yellow metal, and other compound metals. January 18; six months.

John Lienard, junior, of Wharf-road, City-road, Middlesex, merchant, for improvements in purifying or filtering oils and other liquids. January 18; six months.

William Rees, of Pembrey, Carmarthenshire, coal agent, for certain improvements in the preparation of fuel. January 18; six months.

Edmund Pace, of the firm of Taylor and Pace, of Queen-street, London, iron-bedstead makers, for certain improvements in bedsteads, couches, chairs, and other like articles of furniture. January 21; six months.

George Elliot, of Saint Helens, Lancaster, chemist, for improvements in the manufacture of alkali. January 21; six months.

William Burgess, of Newgate-street, London, gutta percha dealer, for improvements in machinery for cutting turnips and other substances. January 21; six months.

Robert William Sievier, of Upper Holloway, Middlesex, gentleman, for improvements in weaving and printing or staining textile goods or fabrics. January 21; six months.

Charles Roper Mead, of Charlotte Cottages, Old Kent-road, Surrey, mechanical engineer, for improvements in apparatus for measuring gas, water, and other fluids. January 21; six months.

John Ransom St. John, of New York, in the United States of America, engineer, for improvements in the process of and apparatus for manufacturing soap. January 21; six months.

Samuel Clift, of Bradford, near Manchester, manufacturing chemist, for improvements in the manufacture of potash, soda, and glass. January 21; six months.

Auguste Loradoux, of Bedford-street, Strand, for certain improvements in machinery or apparatus for raising water and other fluids. (Being a communication.) January 21 six months.

Alexander Samuelson, of Banbury, agricultural implement manufacturer, for improvements in apparatus for cutting turnips, carrots, mangold wurzel, and other vegetables. January 23; six months.

Joseph Bunnett, of Deptford, Kent, engineer, for certain improvements in public carriages for the conveyance of passengers. January 23; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 16	2635	George Ellis	Fore-street, City	Boa.
17	2636	J. Solomon	Red Lion-square	Eye-protectors and concentrators of light for opera-glasses.
22	2637	Hilliard and Thomason	Birmingham	Dress-fastener.
„	2638	Unwin and Rogers	Sheffield	Cigar-holding pencil-case knife.
„	2639	Myers and Son	Birmingham	Penholder.
„	2640	W. A. Adams	Midland Works, near Birmingham	New form of angle iron.
23	2641	R. Daintree, T. Ekins, and J. Nix, junior	Huntingdon	Potato-sorting machine.
„	2642	J. G. Atloff	New Bond-street	Boot, shoe, clog, or galosh.
„	2643	W. F. T. Bradshaw	Sheffield	Bradshaw's improved potter's palette-knife.
„	2644	J. C. White	Liverpool-street	Socket-piece for part of a brace.

CONTENTS OF THIS NUMBER.

Specification of Mr. Thomson's Patent Suction Wheel, Centrifugal Pump Regulator, and Steam-engine Priming Preventor. — (*with engravings*) 61
On Impossible Equations. By Robert Harley, Esq. 66
Paine's New Source of Light 67
Diagonal Bracing in Shipbuilding.—The Invention, not of Sir Robert Seppings, but of Sir Samuel Bentham 70
Captain Jerningham's Registered Letter-clip (*with engravings*) 71
Phenomena of Forced Dilation of Liquids. By M. Marcelin Bartheollet 71
Photography.—Mode of Obtaining Glass Negatives. By Mr. T. A. Malone 72
Niagara Suspension Bridge 73
Patent Law Practice.—New Orders 73
Specifications of English Patents Enrolled during the Week:—
Silvester — (*with engravings*) .... Flattening Steel. 74
Smith .... Folding Paper ... 76
Gossage .... Metallic Compounds 76
Brown .... Casks 77
Dent .... Compasses 77
Bessemer .... Ornamenting Surfaces 77
Mills .... Steam - Engines and Pumps ... 78
Bradford .... Locks 78
Specification Due, but not Enrolled:—
Varillat .... Tanning 78
Recent American Patents 78
India Rubber Gas-holders 79
Jenny Linds 79
Weekly List of English Patents 80
Weekly List of Designs for Articles of Utility Registered 80

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MILLS'S PATENT IMPROVEMENTS IN STEAM ENGINES AND IN PUMPS.

Fig. 1.

Fig. 5.

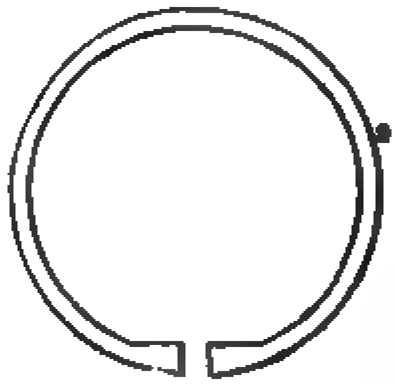


Fig. 12.

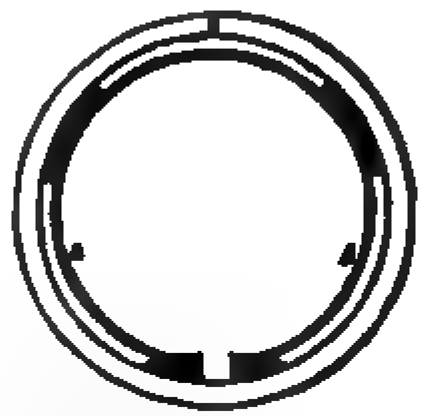


Fig. 6.

Fig. 13.

Fig. 2.

Fig. 16.

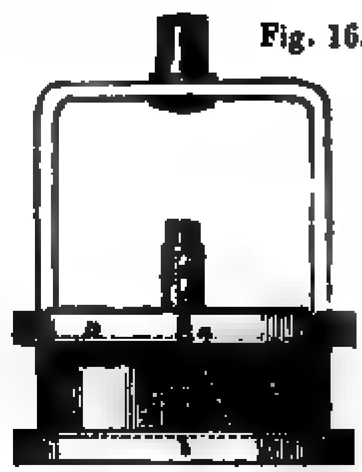


Fig. 10.

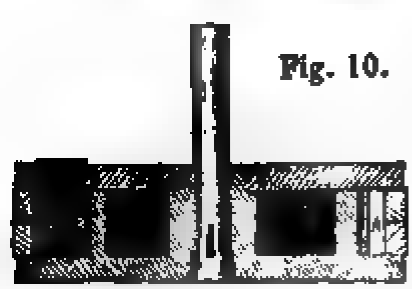
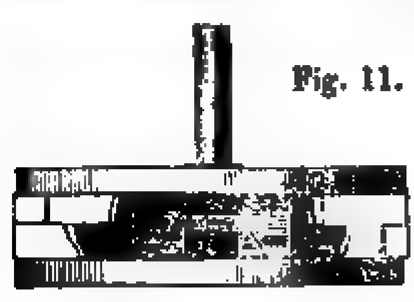


Fig. 11.



MILLS'S PATENT IMPROVEMENTS IN STEAM ENGINES AND IN PUMPS.

(SEE ANTE P. 78).

Specification.

My invention in so far as regards improvements in steam engines and pumps, consists in an improved method of causing the packing of the piston of the plunger, to fit to any inequality there may be in the diameter of the steam cylinder or pump barrel, which method affords at the same time great facilities for increasing the expanding pressure of the packing of the piston or pump bucket during any temporary stoppage of the engine or pump, and without the trouble of taking the piston or bucket out of their places.

Figs. 1 to 14 inclusive, exhibit exemplifications of these improvements applied to the piston of a steam engine. Fig. 1 is a plan of a piston with my improved packing; fig. 2 a plan, with the junk ring removed; fig. 3 a vertical section, and fig. 4 an elevation, partly in section of one variety of this piston. The body A of the piston, and junk ring B, are nearly similar to those of the common pistons now in use. CC are the packing rings, and D an inner ring, which is nearly of the same depth as the two packing rings, and is turned or otherwise finished, so as to bear uniformly with its exterior surface upon the inner surfaces of the packing rings. The ring D has an angular portion cut out of it, as represented in the plan and elevation given separately in figs. 5 and 6; into which angular space there is fitted a wedge E, by which the ring is made to expand to an extent sufficient to cause it to bear against the packing rings. Fig. 7 is an elevation, fig. 8 an edge view, and fig. 9 a plan of the wedge-piece E. F is a cavity formed in the wedge E, which serves for the reception of a nut G and spiral spring H, which is superimposed between the nut and the wedge E. The spiral spring H exerts a constant upward pressure upon the wedge, and this pressure can be increased to any desired extent without undoing the piston, or even having to remove it from the cylinder, by simply turning the screw I, so as to compress the spring. The screw I passes through the junk ring and terminates in a rose-formed head. K is a spring catch which is fixed to the junk ring, and by taking into the notches of the rose head prevents the screw from turning round. (The wedge-shaped piece might be used without the spiral spring; but not so advantageously.)

When pistons of this improved construction are employed in horizontal and oscillating steam engine cylinders, then the back of the wedge-shaped piece should be bevelled as shown at *aa* in fig. 7, and the recess in the piston, into which the wedge-shaped piece is fitted, should have a corresponding bevel cut upon it, so that as the wedge is pressed upwards (in course of the wear of the parts) these two bevelled surfaces may still keep in contact, and thus give firmness to the piston; the advantage of this arrangement will be more especially experienced when the wedge is put at the lower side of the piston in horizontal cylinders. In oscillating cylinders, the wedge is most beneficially placed on that side of the piston immediately opposite to the throw of the crank after it has passed the top of the stroke.

Fig. 10 is a cross section, and fig. 11 an elevation partly in section, of another steam engine piston with a somewhat different arrangement for causing the packing to expand. Fig. 12 is a plan of the packing and expanding rings, separate from the piston. Fig. 13 is an elevation of the expanding ring, which is composed of a thin band or hoop of steel A, upon which there are fitted several bearing-pieces BB, which press upon the packing rings. The steel-band A acts as a spring, which yields in the event of the diameter of the cylinder requiring a corresponding expansion or contraction of the piston to take place, during the act of making a stroke, so that the wedge-shaped piece in this case requires no helical spring.

Fig. 14 is a horizontal section of another modification. AA is the body of the piston; BB, the packing rings; CC, the ring which is expanded by means of a wedged-shaped piece similar to that before described; DDD are springs which are interposed between the packing-rings BB, and the ring C.

Fig. 15 represents the section of a cylinder and cover containing a piston. *a* in the cover shows an orifice through which a key L may be introduced for the

purpose of turning the screw I, whereby the spiral spring may be made to act upon the wedge piece. By this means it is considered that the piston may be adjusted at any time with a delay of only a few minutes' working. The orifice *a* is to be stopped by means of a screw.

Fig. 16 is an elevation, and fig. 17 a plan of a pump bucket constructed upon a similar principle to the pistons before described; AA is an expanding ring, and B a wedge piece as before: C is a screw, by which the wedge is made to cause the ring A to expand. This bucket is constructed for being fitted with a hempen packing, upon which the expanding ring A may act instead of acting upon a metallic packing. DD are two ledges or collars, which are bevelled upon their inner edges, as indicated by the dotted lines *a a*, *b b*, so as to cause the hempen packing as it is made to expand, to become more compact upon the outer surface where it comes in contact with the pump barrel.

And having now described my said invention, and the manner in which the same is to be performed, I declare that which I claim is as follows:—

First.—I claim the constructing of pistons for steam engines and pumps with an expanding ring, acted upon by a wedged-shaped piece acting parallel to the line of motion of the piston, as exemplified by figs. 1, 2, 3, 4, 5, 6, 7, 8 and 9, and before described.

Second.—The two several modifications thereof, exemplified by figs. 10, 11, 12, 13 and 14, and before described.

And, *Third.*—The construction of hempen packed pump buckets, and other pistons in the manner shown in figs. 16 and 17, and before described.

MR. BESSEMER'S PATENT IMPROVEMENTS IN FIGURING AND ORNAMENTING SURFACES.

(SEE ANTE, P. 77.)

Specification.

Firstly. My invention consists in producing patterns, letters, or other figured designs on surfaces, by a process somewhat resembling ordinary letter-press printing, but differing from it chiefly in this, that dry metallic powders (generally known as "bronze powders,") or other dry colours in a state of powder, are used, and which are made to adhere to the surface to be ornamented by means of the pressure of heated rollers, blocks, or plates—the said surfaces having been previously done over with a thin coating of some matter which, after it is dried, possesses the property of becoming again adhesive by the application of heat thereto.

The method now in ordinary use for producing printed designs in bronze powder, is as follows:—A block, with the design engraved in relief, is placed on the bed of an ordinary printing press, and "gold size" or varnish is applied to its surface by an inking roller; an impression is then taken precisely as in ordinary letter-press printing. After the printed impression is taken from the press, it is laid on a table with its printed side uppermost; and some bronze powder is then, with a piece of wool or other soft substance, spread gently all over it. The powder adheres to the varnished parts, and any superfluous portions being removed by wiping the impression gently, the work is so far complete. The impression is then hung up to dry, preparatory to the next process, called "milling." The bronze powder put on to the printed pattern in the manner described, does not possess that amount of brilliancy which is desired—the particles presenting a rough and "matted" surface; it is therefore subjected to this process of milling—that is, the printed surfaces (if sheets of paper) are placed between thin, bright metallic plates, and passed between a pair of rollers. The pressure thus brought upon them causes the particles of bronze to take an impress of the bright metallic plate, and thereby the brilliancy of the bronze impression is greatly increased. When a design in bronze powder is desired to be produced upon grained leather, embossed calico, or other irregular surface, then the difficulty of printing in the ordinary way is much increased, and the process of milling, so essential to the brilliancy of the design, is wholly inadmissible, as it would entirely deface the embossed surface of the calico or grain of the leather. Now one of the chief objects of this branch of my invention is, to overcome this difficulty, and to produce brilliant impressions on those materials where a pressure all over their surfaces would greatly injure them.

Among the most prominent applications of this new mode of figuring and ornamenting surfaces is, that of producing designs in

bronze powder on the covers of books bound in grained leather, embossed calico, &c.

In the manufacture of calico for this purpose, an extra quantity of "dressing" may be used, or its surface may be brushed over with strong parchment size, white of egg, or glair, as it is called, or with a mixture of one part copal varnish and six of spirits of turpentine, mixed together, applied with a sponge, the calico being stretched out on a table during this application. An extremely thin coating may thus be given, for the greater part evaporates quickly, and leaves only a thin film of gummy matter. This last mode of varnishing renders the calico in some measure waterproof, and is so far an additional advantage that, when the material is dry, it may be embossed by rollers in the usual way, in which state it is fit to cover books intended to be ornamented in the manner hereinafter described; or the size, glue, or varnish may be applied after the material is embossed, either over its entire surface or only on those parts where the design is to be produced.

For producing the impression, I use a powerful "arming press," having a heater-box fitted to it as already used in book-binding. The engraved blocks (which I prefer to be made in the manner hereinafter described) are fixed to the heater box, with their engraved surfaces downwards; and these surfaces are highly polished, and kept at the desired heat by the heater-box. The operation is best conducted by a man at the front of the press, to "pull" the impression, and a boy at the back, to put on the bronze. The boy is provided with a shallow box, of somewhat larger area than the engraved block, and of about half an inch in depth: it is provided with a handle, and is filled with bronze powder exactly flush with its upper edge; the surface of the bronze in the box is kept level from time to time by a small "strike," as used in measuring dry goods.

The first operation is performed by the boy, who places the box of powder under the block, and gently lifts it upwards with the left hand, so as to immerse the engraved block about an eighth of an inch into the powder; he then lowers it again, and strikes a blow with his hammer on the top of the heater-box, the vibration of which detaches all superfluous bronze that may adhere to the surface or between the indented portions of the block, leaving a thin and regular coating of powder adhering to the raised parts of the surface. The man in front then lays-on the book-cover, and gives the impression by pulling the handle of the press, and returning it back again. On removing the cover from the press, a brilliant impression will be found corresponding to the raised portions of the block, while the other parts are neither injured by pressure nor covered with bronze; the heat acting on the adhesive matter with which the calico has been previously prepared, causes the powder to adhere firmly thereto, while the bright surface of the block imparts a brilliant surface to the bronze impression, giving it a great resemblance to gold, if bronze of that colour is used. In the interval occupied by the man in removing the finished cover and taking up another to be operated on, the boy applies the bronze again to the block, and so on in succession, so that the work proceeds with great rapidity.

The engraved block may be charged with bronze by evenly spreading the powder on a piece of buff leather or vulcanized India-rubber, glued on to a flat and even piece of wood. The man in this case puts it under the press, which he pulls with very little force; he then lets the press go back, and removes the leather and band; he next places the book-cover under the block, and "pulls the press home," whereby the bronze which was made to adhere by the first operation to the block, is transferred to and fixed on to the cover. By this mode of operating, the boy at the press is not required. In working-off impressions in bronze powder in the manner hereinbefore described, it will be necessary to brush the face of the block occasionally, and rub its surface with a "buff-stick." The kind of bronze best suited for this purpose, is that known as No. 750 or No. 1000; if a coarser description is used, it will be necessary to rub the face of the block occasionally with a piece of buff leather, slightly greased to facilitate the temporary adhesion of the bronze to the block.

Another mode of applying the bronze powder in ornamenting surfaces of this description, consists in substituting a small wire-gauze sieve for the box before mentioned. In this case, the boy places a sieve of bronze on the book-cover, and gently strikes the edge of the sieve, which causes a sufficient quantity of the powder to fall through upon the cover; the cover is then placed under the press, and the block brought down upon it with considerable pressure; after its removal from the press, the superfluous powder is removed by brushing it slightly with cotton-wool or other soft material. In some cases also where it is desirable to produce figures or patterns in bronze powder on materials that would be injured by the milling operation before described, I proceed as follows:—Having prepared an ornamental block with a highly-polished surface, a second one is produced like it by

the electrotype process, in a manner well known. With the last-named, or electrotype block, the surfaces to be ornamented are printed in gold-size or other suitable varnish, and the bronze applied in the usual manner, and brushed off; but instead of using the milling process to bring up a bright face upon the bronze, I make use of the original block in an "arming press;" the printed surfaces are there subjected to a powerful pressure in contact with the highly polished block, which gives the desired brilliancy to the bronze impression, without injuring the other portions of the surface of the material. The second impression is made to register by pin-holes, or other similar means, in a manner well understood.

When it is desired to ornament the surface of paper-hangings, the paper which is generally covered with a body colour, may have a larger quantity of size used in that colour than is usually employed, whereby the bronze will be made to adhere as before described, when the pressure of a heated metallic block is made to act upon it; or the body colour may be mixed with about one-fifth part, more or less, of gum sandarac, gum animi, or other resinous body, in a state of powder, and merely in a state of mechanical mixture with the materials of the said body colour, so that on the application of the heated metallic block, the said bodies will become adhesive, and cause the bronze powder to adhere firmly to the paper. Or, parchment, or glue size, or a mixture of copal varnish and spirits of turpentine may be applied to the surface of the coloured paper in the manner before directed to be used on calico for bookbinding. Whichever of these modes may be adopted of preparing the surface to receive the ornamental design, powder may be applied to the surface of the block or sifted over the entire surface of the paper, as before described. When a repeat of the pattern is required, as on a piece of paper-hanging, care must be taken to place the paper under the arming press; so that each impression shall fall on to the right part; this will be done by pin holes, which will also serve to register any other colour blocks that may be afterwards used to complete the design.

When a large number of any particular pattern is required, the design should be formed in relief upon a metal roller fitted into a frame in a similar manner to the rollers used to emboss paper hangings, the impression roller being heated by gas or by heaters, and moving in contact with a plain paper roller; the paper to be ornamented being made to move between them with a slow and uniform motion. The pattern roller is to be placed below the paper one, and on the lower side of the pattern roller is to be placed a box containing bronze powder, into which the roller dips as it revolves, and becomes charged with bronze. On each end of the pattern roller is a ratchet wheel with rather coarse teeth, and a paul of some 2 lbs. weight is applied to each wheel with a strong spring, so that as the roller revolves, the pauls fall over the teeth of the ratchet, and strike a sharp blow as each of them in succession falls from one tooth to another. By the vibratory action thus produced in the roller all superfluous quantities of bronze which may adhere to the roller are made to fall back into the box, and the roller thus evenly charged with powder comes in contact with the prepared surface of the paper (which is face downwards), and a clear and bright impression is left upon the paper. The apparatus, just described, is also suitable for producing impressions on various textile fabrics which sometimes contain a sufficiency of the adhesive matter used in "dressing" or preparing to require nothing more to take hold of the powder: but silk or satin fabrics may have a coating of glair to assist the adhesion of the powder, or instead thereof, the whole surface may be sprinkled over with sandarac or other pounded gum resin, whereby the heat of the block will cause the resinous powder to become adhesive. and make the bronze adhere also firmly to the fabric.

The superfluous portions of the resinous powder may then be brushed off, and the general texture of the material will remain unaltered while the impressed design will have all the brilliancy that could have been given to it by the milling process. In some cases I make use of the pervious nature of woven fabrics to assist in producing a design upon them. For this purpose I place beneath the fabric intended to be ornamented, a piece of cotton, blotting-paper, or other absorbent body, moistened with strong parchment or gold size, but not so much so as to injure the ornamented fabric by mere contact; when, however, the press is brought down, the moisture passes through the fabric above, and causes the bronze powder to adhere thereto.

In order to facilitate the adhesion of bronze powders in a dry state to surfaces rendered adhesive by heat, I mix with the bronze powder a small quantity of gum mastic, or other resinous gum, in a state of powder, and place the mixture on a hot iron plate, and work it well together with a spatula, adding more bronze until a slight moisture only is perceptible. The plate is then allowed to cool, and the powder will, by the hardening of the resinous matter, lose all the moisture it exhibited in the heated state.

If properly mixed, the surface of the particles of bronze will all have an extremely thin coating of resinous matter which will greatly facilitate their union with and adhesion to surfaces prepared in the manner hereinbefore described.

Although I have herein spoken chiefly of bronze powder as being applied to figured and ornamental surfaces, it will nevertheless be obvious that many other dry colours in a state of powder may be so applied to ornament surfaces by the methods herein described; and although I have mentioned only some of the materials whose surfaces may be thus ornamented, it will, nevertheless be readily understood that this mode of ornamenting may be used in all cases where printing has heretofore been used.

I wish it to be further understood that although I have herein described the use of certain resinous and other bodies to be employed in causing dry powders to adhere to, and ornament surfaces, that I do not confine myself to the use of such materials, as it is evident that other equivalent substances may be used in lieu thereof with greater or less advantage.

Secondly.—My invention consists of an improved composition for figuring and ornamenting surfaces, particularly the edges of books and papers, in a manner resembling gilding. I prepare this composition by mixing bronze powder in a solution of gamboge to such a consistency as to be readily spread with a hair pencil. It should be applied to the books and papers while in the press (as is now the practice in edge gilding) and afterwards well burnished. The same composition may be used as a paint or marking fluid.

Thirdly. My invention consists of certain improvements in blocks, plates, and rollers employed in ornamenting surfaces in the manner before described. The blocks generally employed for impressing designs in gold upon book covers are made of brass, and in consequence of the great pressure used upon them, and the rigidity of the material, their edges soon become rounded, and the sharp lines defaced; in addition to this, brass is too soft a metal to acquire or retain that high degree of polish requisite to produce the best effect when required to bring up a brilliant impression with bronze powder.

I therefore prepare blocks, plates, or rollers, for this purpose, in the following manner: A mere outline of the design required is traced on a flat surface of plane tree, or other suitable wood; and the wood engraver then proceeds to work up a general outline of the pattern, cutting out all large hollows, and not giving any of the fine lines. All the large masses being thus cut out, the block is then to be moulded in fine sand, and a cast taken in what is known as "malleable cast iron." The face of the casting is then ground flat and polished, when the metal engraver will find that it requires only the fine lines to be put in, and a little finishing of the external edges. The task of engraving is thus much lightened. The block is next to be heated to redness in a muffle, and its surface covered with prussiate of potash, and then plunged into cold water; the block thus case-hardened, is to be polished on a tin cap in a manner well understood, by which the beautiful polish peculiar to steel will be given to it, after which it will be found peculiarly adapted for the production of a brilliant impression in bronze powder.

And having now described the nature of my said invention, and the manner in which the same is to be carried into effect, I declare that what I claim is as follows:

First. I claim the improved method of figuring and ornamenting surfaces, before described, that is to say in so far as regards the doing over of the engraved block or plate with bronze or other dry powder, and the pressing the same in a heated state upon the surface to be figured or ornamented; the latter having been previously prepared for the purpose by a thin coating of glair or other like substance, or containing in its composition a sufficiency of adhesive matter (resulting from pressing or otherwise) to render such coating unnecessary.

Secondly. I claim the use of two blocks, or the double operation of printing and pressing, for producing bright metallic impressions on book covers and other surfaces, without injuring those parts of the surface uncovered by the design, as before described.

Thirdly. I claim the ornamenting of woven fabrics by placing them in contact with some other fabric which is moistened all over with adhesive matter, and which upon pressure being applied, supplies the parts pressed with as much moisture as will cause the metallic powders to adhere.

Fourthly. I claim the admixture of gum resins with bronze powders to be used in a dry state for ornamenting and figuring surfaces.

Fifthly. I claim the employment, for figuring and ornamenting surfaces, of the compound of gamboge and bronze powder, before described.

Sixthly. I claim the method herein described of producing blocks, plates, or rollers of "malleable cast iron," for impressing designs in bronze powder on book covers and other surfaces. And

Seventhly. I claim the method of remov-

ing the superfluous bronze powder from the surfaces of blocks or rollers used for ornamenting surfaces, by tapping or striking, as before described.

MANUFACTURE OF ICE.—DR. GORRIE'S PROCESS.

Salud, near Havanna, December 27, 1850.

Sir,—I write from this beautiful suburb of the capital of the Antilles to give you an account of an ingenious invention in operation here, with which I have been much interested, because I conceive it is an admirable device for ameliorating the condition of man in warm climates. It is a machine for transforming water, at all natural temperatures, into ice, by simply mechanical agency, or with so slight an adjunction of chemical action that its influence is hardly recognizable. This transformation it effects so rapidly and in such quantities that, it is believed, ice can be furnished at a cost which will enable the humblest member of the community to enjoy it to the full measure of his wants. It is even contemplated that the abundance with this important article may be produced will modify some of the arts as practised in this island, and be the means of introducing others requiring a moderate natural temperature for their successful production. You may judge of the general delight with which a scheme, proposing to place the greatest of luxuries on a level with the necessaries of life, is viewed in a country where an unremitted high temperature is regarded as the greatest of natural evils.

Soon after my arrival here (about a month ago), I became acquainted with the proprietor of this device, and, in addition to many other acts of politeness, was invited by him to witness a trial he was about to make of its capabilities. It was not, however, till yesterday that he had so far overcome the difficulties in putting together a machine, parts of which were made in different places, and in obviating the defects seldom unattached to novelties in mechanics, as to be able and willing to submit it to observation. I paid much attention to an exposition he gave me of the principle which was rendered subservient to the object in view—to his description of the construction and mode of operation of the machine; and send you the results of his explanation, and my subsequent examination.

On entering a house to which I was directed, as containing the machine, I observed two men turning a crank, which worked an oscillating beam, and was obviously connected with other machinery, but which was so hidden from view that I was unable to understand its nature.

The next thing I saw was, that a wooden box, forming a portion of the apparatus, was opened, and a cubic block of ice—a foot in its sides—beautifully clear and very solid, was taken from the interior. With an atmospheric temperature above 80° Fahr., this was an interesting spectacle; but of course, it afforded no explanation of the manner in which the ice was produced.

Upon the proprietor detaching some portions of the apparatus, consisting of insulating materials used for preserving the cold produced, sufficient of the machine was exposed to view to enable me, aided by a little illustrative description, to understand its construction, and to perceive its whole operation. It is hardly possible to conceive of an invention, promising such valuable results, more simple in theory; or to avoid an expression of surprise that it should be left to this late day to discover it. It must, however, be confessed that this simplicity is confined to theory; for in practice it has been found necessary to make the machinery, by which it is developed, somewhat complex.

To understand this machine, conceive of two vertical pumps, made precisely like steam engines—one of which is adapted to condense atmospheric air, so as to squeeze out of it a portion of its gaseous heat, and the other is constructed to admit of the expansion of the same air connected with the extremities of a beam common to both, and you will form an idea of all that is indispensable to manufacture ice on this principle. It will be obvious to the slightest reflection, that as the air in expanding becomes a powerful absorber of heat, and will greedily take it from all surrounding bodies, ice might be made by simply immersing the cylinder in which the expansion takes place in water. This process, however, would be too tardy a one for business purposes; and the operation, therefore, is prodigiously accelerated by

various adjuncts. In the first place, in order that the free heat of the condensed air may be extinguished, so as to fit it for its highest degree of refrigerative effect, without any loss of time, a pump, connected also with the beam, but bearing a very diminished proportion in size to the air-pump, is made to inject a jet of cold water at, and during every stroke of the machine. And so, a similar pump projects its measure of an uncongealable liquid among the expanding air in the other air-pump, so as to furnish it instantly with the caloric of volume, while the liquid itself becomes cooled at the same time from the heat it parts with. This liquid (a strong solution of salts) is withdrawn from a tank, or vessel designed for the accumulation of "cold," into which, after performing its duty in the expanding engine, it is again sent back through the eduction valves. In this tank the ice is manufactured by simply immersing water, placed in metallic vessels, in the liquid: or with the mechanical addition of occasionally breaking up the adhesions of the ice to the sides and bottom of the vessels, so as to present a new surface of water to the action of the external cold. The reservoir of cold, the expanding engine, the injection pump, and, indeed, every part of the apparatus employed in generating or preserving cold, are so thoroughly concealed from sight and the radiating influence of the external air by insulating chambers, that the processes going on within them are wholly unperceived.

It ought to be mentioned that the condensed air, instead of being transferred directly to the expanding pump, as the above description would imply, passes intermediately into a wrought-iron reservoir, large enough to store a considerable number of cylinder-fulls of air, and, thus any disadvantage from leakage, or the unequal working of the pumps, is obviated.

There are other auxiliaries to the economical and perfect working of the apparatus, both in regard to the consumption of power, and the production of refrigerative effects; but they are not indispensable to the principle, and are not easily explained. Indeed, the entire contrivance presents such an ingenious system of checks and balances, that none but a man well skilled in mechanical science, and endued with a thorough knowledge of the chemical and physical laws of air, under the conditions to which it is subjected, should presume to undertake its construction.

The result of the experiment made here, though conducted upon a very slight knowledge of the principles involved, is, if correctly reported, highly favourable to the usefulness and value of the invention. In comparison with the operation of the somewhat similar invention of our distinguished countryman, Sir John Leslie, it exhibits much more power. With pumps of about 8 inches in diameter, and of 16 inches stroke, condensing and expanding air to and from a tension of three atmospheres, the block of ice I have mentioned, weighing nearly 60 lbs., was produced by the labour of two men in two hours. At this rate, ice can be manufactured, within any part of the tropics, at a less price than it can be imported. But on a larger scale, and with a cheaper power, the results would be found much more advantageous; and no doubt sufficiently so to enable ice to be sold at a price which would render it, as contended, accessible to the poorest classes.

The machine is claimed to be of Cuban origin; but it is well understood here that it is the invention of Dr. Gorrie, a physician of New Orleans, and is, undoubtedly, a precise counterpart, except in size, to one publicly exhibited in that city about two years ago. It is said that the inventor was directed to the discovery by a desire to employ expanded atmospheric air, simply and directly, as a hygienic and cooling ventilation for dwellings; and no more useful or laudable purpose could be assigned to it. But the attendant investigation of the properties of air, by showing the exact and enormous quantity of heat it absorbs in expanding, taught him that this object could be obtained more advantageously, by directing the principle primarily to the production of ice. To illustrate the application of the principle to both purposes, the machine just alluded to was built, and though, from an ignorant and presumptuous interference with the plan, it was only partially successful, yet it was considered at the time to meet every reasonable expectation, and to justify a further continuance of experiments. Whether any thing more has been done with it in the United States I am unable

to determine. Perhaps the inventor, with the versatility and fickleness of his class, has turned his attention to some other device, to be in its turn abandoned; or, being satisfied with the merit of having made the invention, he is unwilling to encounter the vexation which must attend a pursuit of the pecuniary advantages to be reaped from it. Perhaps, with the equally characteristic sensitiveness of men of genius, he is unwilling to engage in the inevitable struggle which he knows the sordid, avaricious, and dishonest are ever ready to maintain, in order to rob the ingenious of the fruits of their labours. Whatever may be his motives for discontinuing (if he has discontinued) the prosecution of an invention, which is, rightly considered, one of the noblest discoveries of modern times, he is entitled to and will receive the honours due to a benefactor of the human race.

The practicability and utility of this invention being established, it would be difficult to estimate its full value without a minuteness of detail inconsistent with either my limits or my objects. The commercial and social advantages of such a means of moderating the greatest physical evil of hot climates, are too important and obvious to require any extended notice. It would not be so easy to calculate all the consequences which a free use of such an invention would inevitably induce upon the habits and modes of thinking of a people enervated and torpified by a continuous endurance of high natural temperature. As temperature exerts a great influence over human nature, a cheap and abundant production of artificial cold would, no doubt, extend that mental power and physical energy which at present distinguish the temperate zones into the tropics. Countries in which natural causes keep the inhabitants in ignorance and barbarism, may, by its means, become the seats of science and the arts. Again; the greater portion of the diseases of hot climates being dependent upon temperature for their cause, the free diffusion of a production which is generally acknowledged to be an effectual preventive, must increase the salubrity of such climate, and with it change their comparative prosperity. To our wide-spread intertropical colonies, in both the eastern and western hemispheres, the invention would be of immeasurable advantage: and if anything could rescue the latter from the apparently hopeless state of abject poverty and desolation into which they have fallen, it would be a discovery which, like this, is calculated, in its extended application, to revolutionize the habits and renovate the hopes of mankind.

J. P.

BRADFORD'S PATENT LOCKS. (SEE ANTE, PAGE 78.)

Specification.

My improvements in locks consist in the addition thereto of spring bolts or catches, which take into the tumbler, or into the bolt of the lock, and are disposed in such positions, that the tumbler or bolt cannot be moved with a picker or other such instrument until the spring bolt or catch has been removed.

Fig. 1 is a back view of a drawer lock constructed with these improvements; fig. 2 is a front view of it, and fig. 3, a view of the interior of the lock, with the cap plate removed. A is the lock plate; B, a cap, which covers the springs C and D shown in fig. 4, which is a view of the back of the lock with the cap B removed. The spring C is immediately opposite to the lock-pin E, which is made hollow, and has fitted into it a small rod or pin a, the head of which rests upon the spring C. Within the pipe of the key there is fitted a pin a^1 of the same size as the pin a inserted into the hollow pin of the lock. The lengths of these pins are so arranged, that when the key is put into the lock it causes the pin a to press against the spring C, and thereby raise up the free end of that spring, which withdraws a pin b, which takes into a hole drilled in the bolt F. The withdrawing of the pin b allows the key to push over the bolt. Unless the key used for the lock were provided with arrangements for acting upon the pin b, the bolt could not be shifted by it. In the bolt there is another hole which receives the pin b when the bolt is in its locked position.

The spring D has a pin e attached to it, which, like the pin b, takes into one or other of two holes $f\,f$, which are drilled in the bolt F, that is, when the bolt is in its locked and open positions, and prevents the bolt from being shifted out of either of those positions, unless when

the pin *e* is withdrawn from the bolt, which is effected by means of the projecting piece *g*, formed upon the lower edge of the key, shown separately in fig. 5, which, during the turning round of the key within the lock presses upon a projecting-ledge *h*, formed upon the side of the plate G. Edge and end views of the plate G are given in figs. 6 and 7. Fig. 8 is an edge view of the entire lock. When the key presses upon the edge of the plate G, it raises up the spring D, and the pin *e*, attached to it from its hold of the bolt of the lock, and allows it during that interval to be shifted, either to be locked or unlocked. Upon the face of the lock there is an arrangement somewhat similar to that last described, by which a pin, e^1 is made to take into a hole *k*, drilled into the tumbler H, and by which the tumbler is prevented from being raised so as to liberate the bolt F until that pin has been removed. The projecting pin g^1, upon the key, actuates the plate G^1, and the spring D^1, in the same way as has been described in regard to the movement of the similar parts upon the opposite side of the lock. The bolt

Fig. 1.

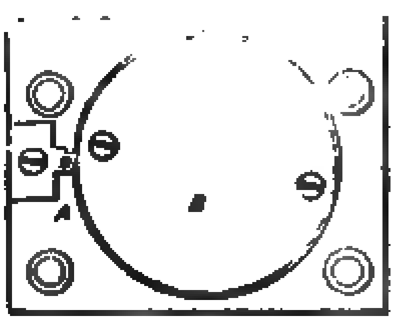


Fig. 4.

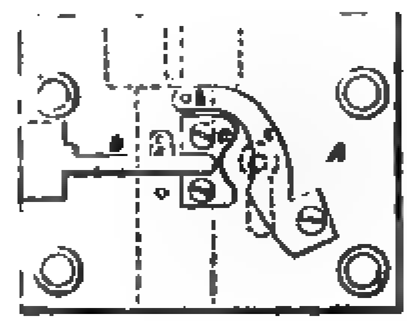


Fig. 6.

Fig. 7.

Fig. 5.

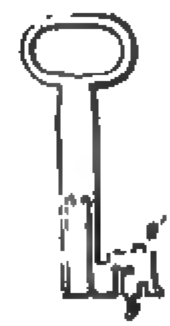


Fig. 2.

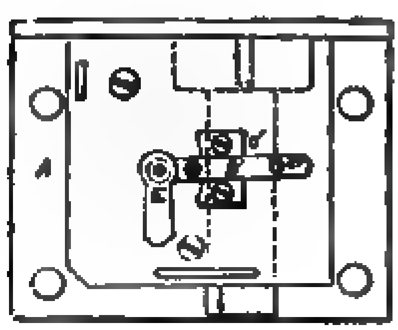


Fig. 3.

Fig. 8.

Fig. 10.

Fig. 11.

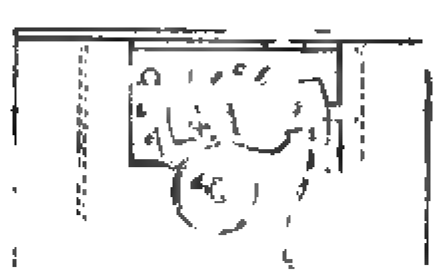


Fig. 9.

F is furnished with a guard F^a, upon that edge of it nearest to the key, which forms a complete obstruction to the passing of any picker over to lift the tumbler.

Fig. 9 is an edge view of a chest lock constructed upon the same principle as the lock just described, and fig. 10 a back view of fig. 9 with the cap removed. Fig. 11 is a front view of the lock with the cap plate removed, in order to show the interior. A is a spring which is attached to the plate of the lock by the screws *a a*, and has a pin *b* connected to it (at the other end), which pin passes through the lock-plate B, and takes into one or other of the holes *c c*, in the bolt C. The bolt C is liberated from the hold of the pin *b* when the key is put into the lock, by means of the pin or rod *d*, which is inserted into the hollow pin

of the lock D, being pressed downwards by the pin a^1, placed in the upper end of the pipe of the key, as before explained. E is another spring which is actuated by the plate F, and carries a pin *e*, which also takes into holes *f f* in the bolt C. The plate F is similar to the plate G, shown separately in figs. 6 and 7, and is raised up by means of the projecting piece upon the edge of the key, all as before explained. From the preceding description given of the additional parts, which I have put to the locks, represented in the engravings, it will be obvious, that the same principles of construction, with very slight modifications, may be applied to locks of other descriptions.

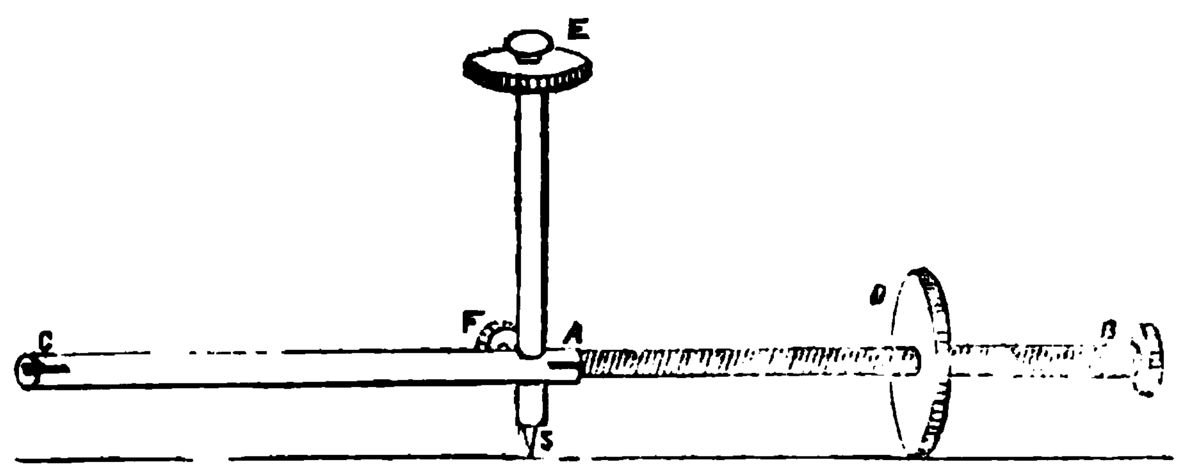
THE SCREW HELIOGRAPH, OR SPIRAL COMPASS.

(Registered by the Inventor, Francis Cranmer Penrose, Architect, November 21, 1850.)

This instrument is intended to draw the logarithmic or equiangular spiral, and especially such forms of it as are adapted to the Ionic-volute and similar scroll patterns.

AB is a screw of a quick pitch; D a nut fitted to it, turned into the form of a disc, and milled on the edge. AC is a plain tube, into either end of which the extremity A of the screw spindle may be fitted. ES is a handle, having a centre point at S, which may be clamped by means of a screw at F, at such distance from AB as may be required by the radius of the disc D.

If it be required to draw a volute,



Place the point S in the centre of the eye of the volute, and the disc upon any known point of the intended curve. By turning the handle E, or, what is generally preferable, by placing a finger of one hand on E, and guiding the instrument with the other, the instrument may be made to turn round S, and the disc D will revolve, and travel up or down the screw according to the direction of the motion, while its path on the paper will be an equiangular spiral. By means of carbonic or other transfer paper, an impression of the track of the disc may be obtained. This will be right or left-handed, according to the worm of the screw. Both right and left-handed impressions, however, may be obtained from the same instrument by placing the carbonic paper alternately above and below the paper on which the volute is required to be drawn; or if the paper be folded, which may be done without creasing, and transfer paper, carbonized on both sides, be placed between the two leaves, one operation of the instrument on the back will draw both volutes. When a spiral radius greater than AB is required, the extremity A of the screw spindle must be fitted on to the plain tube at C.

As in this instrument the pitch of the screw is constant, the rate of convergence of the volute will depend on the diameter of the disc. The instrument will be provided with three tapped discs of different diameters, to which others may be easily fitted if required.

It may be interesting to some of the readers of the *Mechanics' Magazine* to investigate the relation which I have found, both by theory and in practice, to exist between the diameter of the disc and the rate of convergence of the spiral. If x be the diameter of the wheel, and one worm of the screw the linear unit,

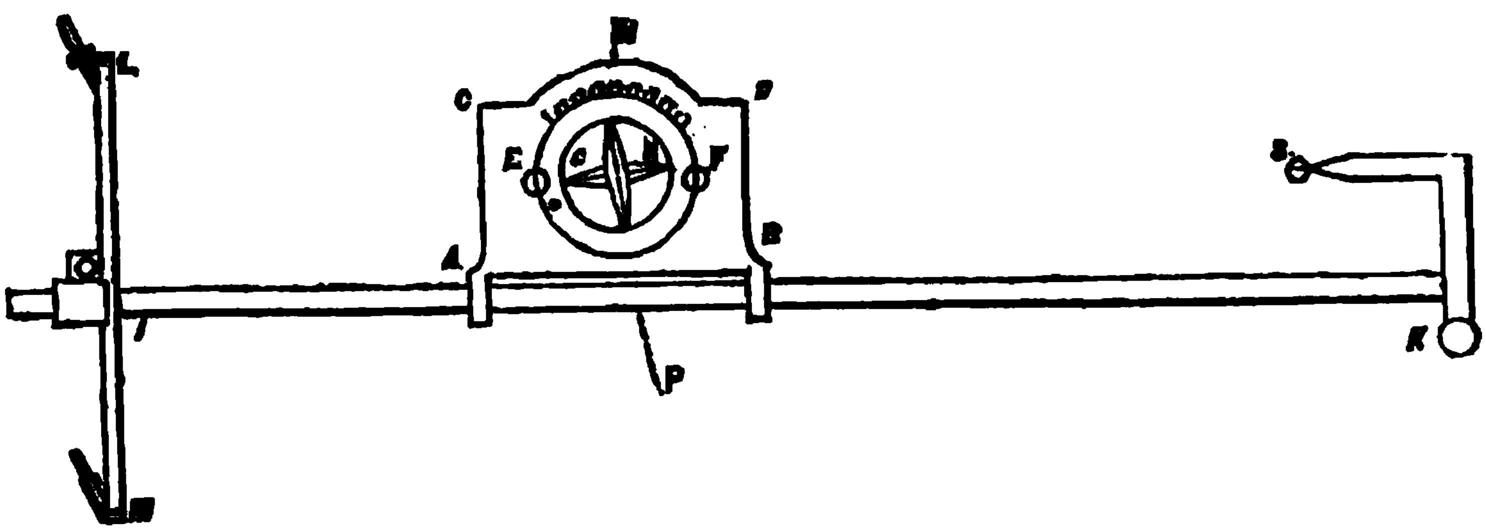
$$a^{2\pi} = \varepsilon^{\frac{2\pi\, x^2 - 2}{\pi^2 x^2 + 3}};$$

where ε is the base of the Napierian logarithms.

F. C. PENROSE.

THE SLIDING HELICOGRAPH.

(Registered December 11, 1850, by the Inventors, Francis Cranmer Penrose and George Forester Bennett.)



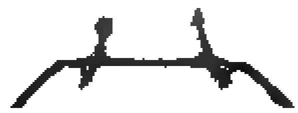
The object of this instrument is to draw volutes and other spiral curves. This is effected by means of the frame A, B, C, D, which slides upon a smooth bar IK through sockets at A and B, which form part of the frame. S is the centre point in connection with the smooth bar, but so much depressed that the frame can pass over it until the point B touches K. The socket at I forms part of a carriage running upon castors M and L; and at K is a gauge screw, which is used to adjust the level of the whole instrument. Within the frame is a circular ring, having attached a small wheel mounted on an axle GH, which turns upon the centre points G and H. If the ring above mentioned be turned round within the frame, the plane of the wheel may be made to occupy any angular position with respect to it. The frame and ring are graduated so as to enable any desired angle to be selected, and clamps at E and F are provided for fixing them at that angle.

Let it be desired to draw any spiral, *e.g.*, an Ionic volute. It is first necessary to place the ring containing the wheel and axle at the proper angle within the frame. Gradations are given on the frame corresponding to those angles which make the proportion between the longer and shorter spiral radii after one revolution integral numbers, as 2 : 1, 3 : 1, ... 10 : 1, &c. The best adapted to a volute is 2 : 1. Place the index against the number 2, and clamp the ring and frame together. After this, fix the point S in the drawing board at the centre of the eye of the volute. Screw down the gauge screw upon the paper, clamp the socket of the castor carriage to the bar IK, and unscrew the gauge screw a few turns. This operation will leave the bar IK level and resting upon the three points L, M, and S, while the whole weight of the frame is thrown upon the wheel.

If the instrument be now made to turn round S, the wheel will revolve, and, by reason of the obliquity of its axle, will cause the frame to slide along the smooth bar, and the path of the wheel will be an equiangular spiral NP, suitable to the volute. The track of the wheel itself may, if desired, be obtained by carbonic or other transfer paper; but the instrument is also furnished with a pen and pencil, not here shown, to avoid complicating the figure. This addition of the pen and pencil, together with the greater range of this instrument, constitute its chief and great advantage over the screw helicograph. The latter instrument seems, however, better fitted to be used on rough surfaces, such as zinc plates for forming templets, or other similar purposes.

F. C. PENROSE.

WELCH'S PATENT GLOBE WINDGUARD, FOR CURING SMOKEY CHIMNEYS.*
(SEE ANTE, LAST VOL., P. 527).



The points gained by this invention are —*little or no obstruction to the natural action or upward progress of the smoke*—and, *the prevention of its return.*

This is effected by merely placing a ball, or globe, of the same diameter, over an ordinary round chimney-pot, so as entirely to cover the flue; and enclosing it in an open cap, which admits the ready dispersion of the smoke.

The globe keeps the flue below it in perfect repose—no downward current of wind being able to touch the smoke until it is clear of the pot.

The globe is fixed simply on a horizontal spindle, on which it revolves to admit of being swept. The area between the globe and cap being equal to the area of the flue, no check whatever is offered to the natural ejection of the smoke, whilst the flue is perfectly protected from downward currents of wind. This invention is found to succeed when all others have failed—and, unless there is some obstruction in the flue which prevents the smoke going up at all, it is a certain remedy.

R.

* Manufactured and sold by Mr. Dawson, of 123, Oxford-street, near the Regent's Circus.

HYDROGEN A METAL.—THEORY IN EXPLANATION OF MR. PAINE'S SUPPOSED DISCOVERY.

(From the *Scientific American*.)

That hydrogen can be rendered more brilliant than is usually exhibited in its combustion, is now a fact beyond dispute. He who doubts this can very easily satisfy himself by transmitting a stream of the gas through pure turpentine-camphine, and burning it as it is evolved by means of a jet. Nor is there any greater pressure needed than that afforded by the bottle or vessel, through which it passes, containing the camphine. Nor does the brightness of the flame at last diminish to the blueish paleness ordinarily seen when the gas is burned without the intervention of a second body, or when passing through impure turpentine.

I use three of Woolf's bottles for the experiment, generating the gas in two of them, whilst the third holds the camphine and jet-tube. I believe the opinion is entertained that the brilliancy is due to a supply of carbon received from the turpentine—an opinion at once contradicted by the fact, that the turpentine loses nothing of its weight, notwithstanding it has given passage to a large quantity of gas consumed. And yet, if it be not carbon which gives the illuminating property to the flame, what is it? I hold that it is the metal of the gas. Hydrogen is now regarded as an exceeding volatile metal. It is true we have not yet reached that power of science by which to cause its reduction to a solid or fluid. But its mode of combination with certain other bodies so closely resembles that of metals; in other words, its taking the place of metals in combination, is proof too stubborn to deny it a metallic character, and it is this metallic character which makes the brightness of the flame. The metal-vapour, like the carbon-vapour of the candle or lamp, has been rendered incandescent, and hence the brightness.

And here another question presents itself, Whence arises this development of metallic energy? My answer is, that it is caused by catalysis. Sometimes the simple presence of one body will cause others to display energies otherwise concealed, or, rather, lying dormant. It is thus with hydrogen—the camphine so catalyses it as to superinduce the development of its metallic energies. The hydrogen then burns with brilliancy, because the metal-vapour of which it consists is then undergoing unwonted ignition.

This, in my opinion, is the only legitimate doctrine which can be urged explanatory of the phenomenon observed in the brilliant combustion of hydrogen—a doctrine which, by-the-bye, goes far to substantiate the general admission that hydrogen is, in nature, a metal. It is, moreover, a doctrine substantiated by the experiments which have been made with a circular cage of fine platina wire, placed immediately above and at a short distance from the perforations of a hydrogen burner. The flame, I understand, becomes intensely bright, and of which I have satisfied myself by simply using the spongy platinum furnished by Mr. Kent, of New York, with his hydrogen generator. The platinum catalyses the hydrogen so as to exhibit more vividly its metallic property in giving a brighter light than when burned without such influence.

The theory which I have thus advanced has not obtained publicity further than what my lectures in the Medical College of this place have given to it. Thinking it worthy of the attention of scientific minds, I send it for a place in your invaluable paper. It is a theory which, doubtless will be assailed; but that is no reason why it should be withheld, but rather a reason for its promulgation, because the collision may strike out a few more of the scintillations of science, and add a little to the dazzling wonders of the age.

C. A. Foster, M.D.

Evansville, Indiana, Dec. 18, 1850.

[It has generally been allowed that water is a compound of two simple substances—oxygen and hydrogen. The late discoveries alleged to have been made by Mr. Paine, go to prove that water is not composed of these two gases; or, as asserted by Mr. Paine, oxygen is composed of one gas and positive electricity, and the same gas is hydrogen when combined with negative electricity. So far as the catalysing of the hydrogen is concerned, to enable it to produce a white light by simply passing through turpentine, the communication from Dr. Foster, confirms all that has been said about it as being perfectly correct. Mr. Nasmyth, at a meeting of the British Association, stated that he believed carbon to be a metal, but we have never heard a single hint relative to hydrogen being one.—*Editor of Scientific American.*]

Mr. Paine's New Source of Light.

Sir,—In the extracts given in your last Number relating to certain experiments made by Mr. Paine, the Editor of the *Scientific American* states, that "When a man has seen water converted

into hydrogen, and nothing else," &c., and thence proceeds to argue that therefore there is room for doubt as to the present theory of water being a composition of oxygen and hydrogen being correct. Now I would call attention to the fact, that there is a definite compound of oxygen and hydrogen, consisting of one atom of hydrogen and two atoms of oxygen, therefore a bin-oxide of hydrogen (having the appearance of water). In all probability, the oxygen instead of being evolved in Mr. Paine's experiments was absorbed, and formed this compound, which is the more likely, as one cubic inch of water will absorb 662 cubic inches of oxygen to form the bin-oxide, and as it (the resulting bin-oxide) is expanded to 1·3 times as compared with water, and it consists of above 1000 volumes of oxygen and hydrogen; consequently 500 volumes of hydrogen would be evolved from one of water in Mr. Paine's experiments. Mr. Paine may, therefore, have been deceived by the quantity of hydrogen given off without any oxygen appearing; but as I have above shown, the absence of this element may be accounted for. To prove the correctness of my hypothesis, let him examine the composition of the compound left in the decomposing cell. As this is a subject on which I have with others experimented to a considerable extent, I can offer Mr. Paine a suggestion which may be of use to him; that is, to consider the resistance or friction naturally offered by ALL bodies to electricity, which so far impedes its progress that it is the only reason why it cannot be employed for the decomposition of salts and other bodies in a manufacturing sense. This I can prove, and shall be happy to do so.

I am, Sir, yours, &c.,
S. L. FREEMONT.

1, Clarence-place, Stepney-green,
January 30, 1851.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING FEBRUARY 6, 1851.

HENRY PRATT, of New Bond-street, camp-equipage manufacturer. *For improvements in the construction of portmanteaus and travelling trunks.* Patent dated July 9, 1850.

The lid of the portmanteau or travelling trunk, which forms the subject of this patent, is composed of two parts or cases, opening at opposite ends, and hinged at the centre to the central framing which divides the upper part of the body of the trunk into two compartments equal to about half the depth of the whole. One of these, when the central framing is fixed, may be fitted with a hat-box; but, if desired, the framing may be hinged at the bottom, so as to fall down, and throw the two compartments into one. The lower half of the trunk is occupied by two drawers; the top one, which is intended to contain shirts and other light articles, being the shallower of the two. The ends of the trunk fall down, so as to give access to the drawers from the ends. In ladies' travelling trunks the drawers are opened from the front, which is, in this case, hinged at bottom, while the ends are fixed. In the latter there is also some difference in the arrangement of the upper compartment and the drawers. In both, the handles are attached to straps encircling the trunks, instead of being, as usual, fixed to the body. Additional handles, secured in the ordinary manner, may also, if desired, be employed. These portmanteaus may be made not only of iron and leather, but of other materials, such as millboard, paper, or waterproof cloth.

Claims.—1. Constructing portmanteaus, travelling trunks, or wardrobes, with double lids jointed in the middle, and made to open from opposite sides or ends; such portmanteaus or travelling trunks having separate compartments or drawers, in which various description of articles and wearing-apparel may be placed and kept apart from each other.

2. Attaching the handles of portmanteaus to straps instead of to the body of the portmanteau as is usually the case.

EZEKIEL EDMONDS the younger, of Bradford, Wiltshire, cloth manufacturer. *For improvements in the manufacture of certain descriptions of woollen fabrics.* Patent dated July 17, 1850.

Claim.—The weaving or manufacturing certain descriptions of fabrics known by the names of "superfine cloth," "double-milled," and "beaver" cloth, and blankets, by throwing two or more small threads or wefts one by one, lying evenly side by side, across the warp threads (by preference, however, using only two abb or weft threads), the one having been beaten or forced into its place by band or power, before the other is thrown across the warp threads, and the second thread being beaten into its position by the side of the first one already so beaten, and so on for any additional threads if required, before the crossing of the warp threads as described.

JOHN MELVILLE, of Upper Harley-street, Esq. *For certain improvements in*

the construction of railw iys and locamotive engines and carriages. Patent dated July 17, 1850.

The improvements here specified and claim-d are—

1. A mode of forming continuous longitudinal bearings of cast iron tubes of circular or elliptical section, and having a channel or rib formed on their upper side to carry wrought iron rails of the forms described—that is, either T-shaped or of the form of an inverted trough. The tubes are connected to each other by flanges and bolts, and care must be taken that their meeting point is not also that of the rails they carry. It is suggested that such tubes might be employed for "oral" communication, or to receive the wires of the electric telegraph.

2. The application to the periphery of the driving wheels of locomotives of a thin stratum or film of some viscous or adhesive substance (such as Bastenne tar or marine glue—the former being laid on with a brush, the latter with a hot iron), capable of being easily renewed in whole or in part, and with or without a gritty or earthy material applied on the surface of such substance—the object being, in either case, to secure a greater amount of adhesion between the wheel and the rail.

3. The application to railway wheels of woollen, or coir, or other suitable fibrous substance, or of cork or India-rubber, between the felloe and the tyre. A layer of the elastic material is first placed around the felloe, then two iron bands round that, and outside a second layer of elastic substance. The whole is then placed within the tyre, which it should just fit, and wedges are introduced between the bands of iron, and driven in tight. The intermediate spaces are filled with pieces of wood, and the whole properly secured by bolts to the tyre, which is provided with an additional flange for the purpose.

4. A peculiar construction of buffer. The spring of this buffer is composed of a number of steel rings or bands secured to each other at one point, but arranged in such manner that each ring has its plane at right angles to that within and without it.

5. Two constructions of suspe.ding springs. The first of these is composed of a number of rings of steel, placed one within the other, the whole connected together and to the axle at one point. The second is formed of a coil of coir, crossed by an elastic band, or encircled by a band of spring steel. The vacant space at the centre of the coil may be filled with a block of vulcanized India-rubber.

6. Forming the apparatus for connecting carriages together so as to be rigid, but admitting at the same time of a longitudinal movement. This link is to be made sufficiently strong to bear the weight of a carriage in the event of a wheel coming off.

7. A peculiar construction of break, in which the friction takes place between the surface of the break and the rail with which it is brought into contact, whilst the wheels are allowed to revolve.

8. A shoe or skid, by which the wheel of the carriage is borne off the rails by the skid. The wheel can only be released in this case by backing the railway carriage.

Henry Constantine Jennings, of Great Tower-street, London, practical chemist. *For improvements in rendering canvass, and other fabrics and leather, waterproof.* Patent dated July 22, 1850.

The present improvements are based on the double decomposition of metallic salts by soluble soaps. Any salts and soaps may be employed. In carrying his invention into effect, Mr. Jennings dissolves 112 lbs. of soft soap in a copper with from 25 to 30 gallons of water, and while at the boiling heat he adds to this from 56 lbs. to 66 lbs. of sulphate of zinc (white vitriol). The sulphuric acid of the salt combines with the alkali of the soap, and the oxide of the salt combines with its oil or stearine, and forms an insoluble metallic soap, which when cold rises to the surface of the liquor (a solution of sulphate of potassa or soda), and has the appearance of a white hard mass. This is afterwards reboiled, to purify and separate from it any sulphate of potassa or soda which might hang about it. The next step is to take 50 gallons of raw linseed oil, and boil it with 5 lbs. of American pearl-ash or with carbonate of potassa until it assumes a soapy appearance. If the water-proofing preparation is required to be of a very light colour, there must now be added about 10 per cent. of the weight of oil, of animal charcoal, and an equal quantity of water. After boiling for about an hour, the oil must be separated and filtered to remove the phosphoric acid and phosphate of lime, by which it will be rendered bright and transparent. 2½ lbs. of acetate of lead, 2 lbs. of litharge, 4 lbs. of red lead, and 21 lbs. of black rosin, are now mixed with the oil, boiled for an hour, and well stirred to prevent their subsidence. In this mixture (at boiling heat) is then placed 30 lbs. of the metallic soap, which is well stirred till dissolved, when the addition of two gallons of a solution composed of caoutchouc dissolved in essence of turpentine, in the proportion of 24 ounces to the gallon, completes the process. As soon as the mixture has cooled down to 160° Fahr., or thereabouts, it may be applied with a brush to the canvass or other textile fabric to be water-proofed. Two coats will be found generally sufficient,

but a third may, if desired, be applied. Each coat should be allowed to dry before another is laid on. The salts employed give their own peculiar metallic colour to the mixture—thus those of lead and zinc produce a white; of iron, a brown; of cobalt, a blue, &c., &c.

For waterproofing leather, the patentee dissolves in raw linseed oil an equal quantity of any metallic soap. The leather is placed in the preparation at a temperature of 225° Fahr., and remains there till it becomes cold, by which time the moisture and air in the pores of the leather will have been displaced by the preparation, which does not at all affect its pliancy. The leather is dried by exposure to the air, and the whole process of saturation and drying do not occupy more than forty-eight hours.

Claim.—The use of metallic soaps produced as above, or by any other means of double decomposition or chemical agency, in combination with raw linseed oil, or with linseed oil prepared as above described, and their application to textile fabrics of all kinds, and for rendering leather waterproof. Also, the use of animal charcoal by the process described, for decolorating drying oils, by first mixing them with ammonia, or any other of the fixed alkalies. Also, the mode of using raw linseed oil mixed with alkalies and afterwards neutralised by acetate of lead, or any other chemical agent of analogous affinity, and the use of boiled oils or varnishes mixed with metallic soaps, when the smell, colour, and application of the same permit, as a dressing for canvass, &c.

JOSEPH PAXTON, of Chatsworth, Derby, gentleman. *For certain improvements in roofs.* Patent dated July 22, 1850.

The principal novelties claimed by Mr. Paxton with reference to his improvements in roofs of the ridge and furrow description, are

1. Constructing the external and internal gutters of one piece of wood instead of building them up of several pieces.

2. Cambering the gutters by means of trusses, to facilitate the flow of water from the centre of the gutter towards its ends.

3. Making sash bars with a groove at each side, and a portion of the fillet removed on one side.

4. Constructing roofs in such manner that the covering which excludes the weather is included within the truss which supports it instead of being placed upon it, as in the ordinary construction of roofs.

GEORGE DUNBAR, of Paris, gentleman. *For improvements in suspending carriages.* Patent dated July 23, 1850.

These improvements consist in suspending the carriage from the axle by flexible bands, braces, slings, or cords, placed either single or double at each side of the axle to which they are secured in the middle, the ends being attached to the shafts which bear the weight of the body.

Claim.—The means described of suspending carriages.

LEONARD BOWER, of Birmingham, manufacturer, and THOMAS FORTUNE, of Harborne, Stafford, mechanic. *For certain improved machinery for manufacturing screws, bolts, rivets, and nails.* Patent dated July 23, 1850.

Claims.—1. A machine for slitting or forming the grooves in the heads of screws and screw blanks.

2. A machine for turning the heads o screws and screw blanks.

3. An arrangement of apparatus by which screws and screw blanks are delivered one by one to the slitting, turning, and worming machines.

4. Different constructions of forceps for transferring the screws and screw blanks from the feeding apparatus to those portions of the machine by which the slitting, turning, and worming are effected.

5. An arrangement of apparatus for supplying screws to the feeding apparatus.

6. The interposition of a spring between the cutting tools or dies and the cam, by which the said tools are acted on to enable the tools to yield in the event of any derangement of the machinery.

7. The interposition of a spring between the forceps for holding the screws in the slitting machine, and the cam by which the forceps are actuated.

8. A machine for making rivets and bolts.

9. A peculiar construction of taper die to be used in the manufacture of nails.

WILLIAM BEETSON, of Brick-lane, St. Luke's, brass-founder. *For improvements in water-closets, pumps, and cocks.* Patent dated July 23, 1850.

The improvements here claimed are—

1. Making the pan, of glass or earthenware, and the lower part of the water-closet of glazed earthenware, in combination with an upper and lower plate and bolts. Also facing the valve with earthenware, slate, or stone, and several arrangements shown for emptying the pan and working the valve.

2. A method of working the piston rods of pumps. (The handle is attached directly to the rod, and has its fulcrum in fixed slotted bearings; it is also provided with projecting studs which slide in slotted guides, and serve to retain the piston rod in its proper position.) Also a mode of arranging the valves of pumps so as to be easily removeable. (The valves are in this case hinged to a moveable piece, by

which the object in view is secured); and a mode of applying a flat, instead of a dished piece of flexible material to the barrels of pumps which are required to be fluid-tight, while the handle or lever passes inside the barrels.

3. Various combinations of parts as shown in the construction of cocks. The valve is opened in some cases by removing a lever which retains it in its place. The same object is attained in others by raising a kind of piston. The plugs are also made of slate, bushed in some flexible material. The application of a fine metal as a bushing for the plug, in cases where the pump barrel is of iron, constitutes another of these improvements.

LANGSTON SCOTT, of Moorgate-street, London, wine-merchant. *For improvements in a mode or modes of preparing certain matters or substances to be used as pigments.* Patent dated July 24, 1850.

Mr. Scott's mode of preparation consists mainly in employing a clay retort such as is used in the manufacture of gas, bedded in sand or finely-pulverized pumice or other substance which will not be affected by the heat necessary to vaporize the zinc, and set in masonry over a fire-place properly provided with flues and dampers. The retort has an orifice at each end, one connected with a recess in the masonry for introducing the zinc to be operated on, and the other in communication with a chamber through which the vapours have to pass on their way to the condensing chamber. This chamber terminates at bottom in a receptacle for the heavy oxide, and has an orifice and slide to regulate the admission of air immediately opposite to the exit orifice of the retort. The zinc is placed, in the metallic state, in the before-mentioned recess, which is then closed with bricks or otherwise, and luted. When melted, the zinc flows down into the retort, from which, on the application of a greater degree of heat, it emerges in the state of vapour. This enters the chamber at the exit end of the retort, comes in contact with the air admitted there, and passes onward through a flue or shoot to the condensing room. It is here condensed, and falls down on the floor, which is made in the shape of a series of funnels, having under each a cask to receive the white zinc which will be in a fit state to be employed as a pigment in the ordinary manner. The patentee prefers to cover the condensing room with a shallow cistern of cold water, and to make also near the top an exit orifice (provided with a screen of wire gauze), so as to ensure a slight draught of air through the room.

Claims.—1. The setting or bedding a clay retort in sand, or other pulverised material, to be employed in the manufacture of white zinc.

2. The mode described of supplying zinc to the retort.

3. The combination of the chamber, flue, or shoot, and method of supplying air, as described.

4. The mode described of collecting the white zinc in a dry state.

WILLIAM EDWARD NEWTON, of Chancery-lane, civil engineer. *For improvements in machinery for cutting files.* (A communication.) Patent dated July 23, 1850.

Claims.—1. A method of adapting the file to be cut to the cutting edge of the chisel or cutter, so that an equal force may be applied to the whole breadth of the file by shifting the file relatively to the cutting edge.

2. Connecting the chisel with the slide by which it is operated, by means of a joint whose axis is at right angles to the plane of the cutter, so as to give the cutting edge the requisite angle, and render it self-adapting to the varying texture of the metal under operation, and to the varying planes presented by the face of the file (as it passes under the cutter) by reason of its curved form and the obliquity of the cuts required.

3. Regulating the tension of the spring employed, or its equivalent, so as to determine the force of the blow by causing the plane on the carriage to act on the said spring, or its equivalent, whereby the force of the blows can be adapted to the form of the file.

WILLIAM EDWARD NEWTON, of Chancery-lane, civil engineer. *For improvements in obtaining, preparing, and applying zinc and other volatile metals, and the oxides thereof; and in the application of zinc or ores containing the same to the preparation or manufacture of certain metals or alloys of metals.* (A communication.) Patent dated July 23, 1850.

Claims.—1. An improvement on what is known as the Belgian furnace, for reducing zinc—this improvement consisting in the arrangement of the fire-place or places and flue or flues, so that the products of combustion, after giving off their caloric to the retorts in the chamber, instead of passing off at the top, are reverberated by the closed arched roof, and carried downwards and conducted away through openings situated at or near the bottom. Also, the use of the improved furnace described, formed by making the front and rear walls of the retort chamber, in which the retorts are heated, of hexagonal blocks, with central orifices to receive the ends of the retorts—and this whether for reducing zinc or other metals. By these arrangements, not only is the heat

more equally diffused, but a much greater number of retorts may be employed.

2. The use of an oven, retort, or muffle, formed of fire-bricks, for reducing the ores of zinc to the state of an oxide, connected with a fire chamber at the side or end of the retort or oven, so that the products of combustion pass through the spaces surrounding the oven, in which oven the metallic fumes are oxidated by the admission of atmospheric air by suitable means.

3. Alloying iron or steel with volatilized zinc, whether obtained from metallic zinc or from any of the ores thereof. This operation is similar to the conversion of iron into steel, and may be performed in the ordinary cementation furnace. Any of the native oxides of zinc, such as the red oxide and "Franklinite" (which latter, however, is more properly an ore of iron) may be employed, as may also the prepared oxides, provided they be free from arsenic, sulphur, or other substance or quality detrimental to iron and steel.

4. The employment of a bag or chamber with porous sides, or of an air-tight chamber provided with a straining or porous bag adapted to its interior, in connection with a blowing or exhausting apparatus, by which the products of the distillation and oxygenation of zinc, and other volatile metals, may be separated from the accompanying air and gases,—which latter will be forced, or otherwise drawn through the pores of the cloth, and conducted into the air; and the employment of the same apparatus for obtaining the blue or metallic powder of zinc, and the products of the distillation of other volatile metals. Also the use of a condensing or collecting pipe slightly elevated at the end, and provided with an aperture for the escape of the gases, or, otherwise, a horizontal condensing or collecting pipe, with a smaller ascending pipe at the further extremity to aid in giving a slight draught to the escaping gases.

5. The fabrication and use of the pigments derived from the ores and oxides of zinc prepared as described, and the admixture of the gray oxide and blue metallic powder of zinc with the pulverized oxides and ores to produce an electro-magnetic effect when applied to metallic surfaces, to protect them from oxidation. The sulphuret, carbonate, and red oxide of zinc, and Franklinite, are the substances here alluded to. Both these latter contain certain portions of oxide of iron and of manganese, but the Franklinite to the greatest extent. When roasted and pulverized, the red oxide produces a rich dark brown, and the Franklinite, with a slight admixture of lamp black, a very good black.

6. The application of Franklinite to the improvements of iron during the process of reduction, and in the finery and puddling of crude and pig iron, according to the methods described, and also the application of a receiver or collecting chamber in conjunction with an intermediate flue, or a chamber or chambers, or apparatus of the kind described, to prevent the escape of the fumes and vapours of zinc produced during such process.

Charles William Bell, of Manchester. *For improvements in apparatus connected with water-closets, drains, and cesspools, and gas and air-traps.* Patent dated July 25, 1850.

Mr. Bell's improvements consist in the employment of a collapsing passage formed of vulcanised India rubber, which will permit the escape of the soil, sewage, liquid, gas, or air, in one direction; but by closing as soon as these have passed prevents their return. When formed of India rubber, it is preferred to maintain the pipe in the form it would assume when collapsed during the process of vulcanizing by which the required set will be ensured.

Claim.—The manufacture of collapsible passages of vulcanized India rubber, connected with water-closets, drains, and cesspools, and gas, and air-traps,

George Hazeldine, of Lant-street, Southwark, carriage-builder. *For improvements in the construction of wagons, carts, and vans.* Patent dated July 23, 1850.

In constructing the side framing of wagons, carts, and vans, it has been usual hitherto to employ numerous cylindrical "stafs," which were driven through the "raves" or top rail, and into the bottom or bed of the flooring. The "raves" were also strengthened by placing "stud stafs" at intervals. According to this method of construction, the stafs are very frequently broken, and the expense of repairs is considerable; moreover, the nuts by which the stafs are secured project above the upper surface of the raves, and prevent any goods or packages placed thereon being drawn or slided towards the ends of the wagon or van without great damage to such goods or packages. Mr. Hazeldine now proposes to employ raves of angle iron, the outer one T-shaped, and the inner one ꓕ-shaped, and to dispense with stafs driven as above described. He employs stud stafs, as usual, and has also an iron bar, with belaying pins parallel to the raves. He further strengthens the frame by diagonal bars at the end, for attaching the tail-board, and also for staying the front pillars of the framing, to which he also attaches corner irons with rings. The seat is made with a box under it for holding wrappers, covers, and nose-bags.

A stop for the poles of wagons and vans

is lastly described. This is hinged to the pole-socket, and when the pole is introduced, falls into a recess, and prevents its being withdrawn without first raising the stop or catch.

Claim.—The method shown of combining the various parts in the construction of wagons, carts, and vans, and the stop described as applied to the poles of wagons and vans.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Joseph Crossley, of Halifax, for improvements in the manufacture of carpets, rugs, and other fabrics. January 28; six months.

Samuel Morand, of Manchester, for improvements in apparatus used when stretching and drying fabrics. January 30; six months.

Bennet Woodcroft, of Furnival's-inn, for improvements in machinery for propelling. January 30; six months.

James Murdoch, of Staple-inn, Middlesex, for certain improvements in preserving animal and vegetable substances. (Being a communication.) January 30; six months.

Charles Gotthelf Kurd, of Paris, France, engineer, and Charles Alexis de Wendle, iron master, also of Paris, for improvements in the process and instruments to be used for boring the earth, and sinking shafts of any given diameter, for mining and other purposes, and in the means of lining such shafts. January 30; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in manufacturing looped and other woven fabrics. (Being a communication.) January 30; six months.

Richard Johnson, of Manchester, wire-drawer, for certain improvements in annealing articles of iron and other materials. January 31; six months.

Juan Neponniceno Adorno, of Golden-square, Middlesex, gentleman, for improvements in the construction of maps and globes, and in apparatus for mounting the same. January 31; six months.

Charles Marsden, of Kingsland-road, Middlesex, engineer, for certain improvements in boots and shoes. January 31; six months.

George Bradshaw, of Bishopsgate-street Within, London, hosier, for certain improvements in fastenings for garments. January 31; six months.

Jean Paul Gage, of Paris, France, chemist, for improved chemical compounds for tissue bandages, wafers, and also for surgical purposes. January 31; six months.

David Davies, of Wigmore-street, Cavendish-square, Middlesex, coach maker, for certain improvements in the construction of wheel carriages and in appendages thereto. January 31; six months.

John Davie Morris Stirling, of Black Grange, North Britain, Esq., for improvements in the manufacture of metallic sheets, and coating metals, in metallic compounds, and in welding. January 31; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 24	2645	B. Barling, E. Barling, and W. Barling	High-street, Camden-town	Catch top mount for smoking pipes, and other articles of manufacture.
,,	2646	R. M. Vick	Gloucester	Hames.
,,	2647	S. Weil and S. Flattan	Mile-end	Sock (for infants).
,,	2648	J. Hawkins	Walsall	Bit for horses.
27	2649	P. R. Jackson	Salford Nolling Mills, near Manchester	Stink-trap.
29	2650	A. Graham	Glasgow	Gas cooking range.
,,	2651	W. Pulford	Boston	Archimedian nut-cracker.
,,	2652	W. Butterworth and Co.	Great Dover-street, Southwark	Elastic boot legging.
,,	2653	W. Moat	Hammersmith	Fiddle bow.

CONTENTS OF THIS NUMBER.

Mills's Patent Improvements in Steam Engines and Pumps—Specification—(*with engravings*) 81
Bessemer's Patent improvements in Figuring and Ornamenting Surfaces—Specification ... 83
Manufacture of Ice—Dr. Gorrie's Process 87
Bradford's Patent Locks—Specification—(*with engravings*) 89
Penrose's Screw Helicograph, or Spiral Compass—(*with engraving*) 91
Penrose and Bennett's Sliding Helicograph—(*with engraving*) 92
Welch's Patent Globe Windguard—(*with engravings*) 93
Hydrogen a Metal—Theory in Explanation of Mr. Paine's supposed Discovery. By C. A. Foster, M.D. 94
Paine's New Source of Light. By Mr. S. L. Freemont 94
Specifications of English Patents Enrolled during the Week:—
Pratt ...... Portmanteaus 95
Edmonds ...... Woollen Fabrics 95
Melville ...... Railways 95
Jennings ...... Waterproofing 96
Paxton ...... Roofing 97
Dunbar ...... Carriages 97
Bower & Fortune ...... Screw-bolts, &c. 97
Beetson ...... Water Closets 97
Scott ...... Pigments 98
Newton ...... Files 98
Newton ...... Zinc Manufacture ... 98
Bell ...... Water Closets 99
Hazeldine ...... Wagons 99
Weekly List of New English Patents 100
Weekly List of Designs for Articles of Utility Registered 100

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PIRSSON'S PATENT STEAM-ENGINE CONDENSER.

Fig. 1.

Fig. 2.

Fig. 6.

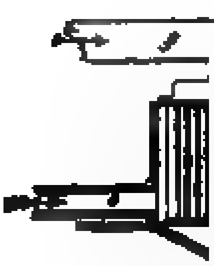

Fig. 3.

PIRSSON'S PATENT STEAM ENGINE CONDENSER.

[Patent dated July 31, 1850. Patentee Joseph Poole Pirsson, of New York, Civil Engineer. Specification Enrolled January 31, 1851.]

We noticed in our last vol. p. 418, the successful adoption on board the American steamer, *Osprey*, of a new description of condenser invented by Mr. J. P. Pirsson, of New York. It has been in continued use in that vessel (of 1000 tons burden) for about twelve months; and when the boilers were recently examined, there was not the slightest scale or deposit to be seen. The condenser itself, too, was in excellent order. The invention has been patented in this country, and we now lay the specification of it before our readers:—

Specification.

Fig. 1 is a side elevation; fig. 2 is a top view; fig. 3 is a longitudinal section. Figs. 4 and 5 are views showing variations in the construction of the same apparatus. Fig. 6 is a view of a common condenser.

To condense steam to water, it must be brought in contact with some element of less temperature than itself; and the extent and rapidity with which it can be affected, will be as the difference of temperatures and the conducting quality of the condensing element. The usual modes of condensing steam, where it is used as a motive power, are by allowing it to escape into the air; by injecting it into a vessel or vessels which are kept at a low temperature by immersion in cold water, or a current of air, the steam being cooled by contact with the metal; and by injecting it into vessels, in which it is brought in direct contact with a jet of water. In the first instance, the water resulting from the condensation of the steam is lost; in the second it is retained in the vessel in which it is confined, unmixed with any other substance; in the third it is retained, but is mixed with the water used for condensing it. Condensing engines are those which employ one or the other of the two last described plans. In marine engines, or where salt, or other impure water is employed for condensing the steam, this latter plan involves the loss of the fresh water resulting therefrom, in a manner well known, and consequently either the boilers must be supplied with bad water, or a supply of pure water must be specially provided.

In most cases this cannot be accomplished, as it has been found impossible to carry a sufficient quantity to last for any great length of time.

This being the case, attention was early (in the history of the steam-engine) given to perfecting the second mode named herein—viz., the condensing of the steam by radiation in closed metallic vessels, kept submerged in water. In this plan the boilers are to be first filled with pure water; the steam being condensed back to water, is thus caught and returned to the boilers, to be used over and over again; the leakage and waste being supplied from reservoirs provided with an extra quantity, or by distillation. The steam being condensed in vacuo, the external surface of these vessels is thereby subjected to the pressure of the atmosphere, and also to the pressure of a column of water, proportioned to the depth at which they are immersed. In fig. 6 is a view of the usual mode of constructing this kind of condenser; *a* is a cluster of pipes (that being the best form to resist pressure) inserted in two flanges *b*; the ends of the pipes are covered at *c* by a cap, and at *d* by the channel in the bed-plate; *e* is a tank to hold the water for condensing, which flows in and out as indicated; *f* is the exhaust pipe for conveying the steam to be condensed; *g* the air pump. The steam is thus condensed by coming in contact with the cold surface of the metal, the pump *g* maintaining the vacuity of the pipes by removing the water as fast as it accumulates in the channel *d*, and also any air or other gases. Hence the external surfaces of the tubes are subjected to the pressure of the air, and also to that of the column of water in which they are immersed, as before named. This mode of condensing steam has these difficulties to contend with, and which have hitherto been found insuperable. The alternate heating and cooling of the metal pipes consequent upon the periodical injections of the steam, causes a series of expansions and contractions to be continually going on. In addition to this, the great pressure upon them soon produces fractures in the various

joints and seams, which at once destroys the whole operation, as the vacuum can no longer be maintained from the flowing in of the air, and also of the water, which is fatal to the whole operation.

Having thus stated the peculiar character of the old modes of condensing steam, I shall now proceed to describe my improvements and to set forth wherein they differ from all others.

Fig. 4.

Fig. 5.

At the letter *h* is represented a box or case composed of metal, and of sufficient strength to resist the pressure of the atmosphere, and is also to be made as perfectly air and water-tight as possible. In the under side of the box *h*, there is an opening *i*, through which a connection is made by a pipe or channel *k*, with an air-pump *l*, of common construction, as shown in section, fig. 3. At *m* is a perforated plate, on which the condensing water is received, and is for the purpose of dispersing it in a manner well known. At *o* a pipe and cock are attached for injecting the water for condensing the steam. Into the box thus constructed, I next introduce a radiating condenser, that is to say, a vessel or apparatus in which steam is to be condensed by contact with cold metallic or like surfaces, which I make as follows: At *n*, fig. 3, is

seen a number of tubes arranged horizontally, their ends being fixed in plates or flanges of metal, having holes perforated to receive them; next I cover the ends of the tubes by attaching caps, *p* and *r*, to these plates, as shown in section, fig. 3. The tubes thus arranged, are introduced within the box *h*, as shown. In the cap *p* there is an opening made at *s* to receive the end of the pipe which conveys the steam to be condensed, which pipe is seen at *s'*. The steam pipe *s'* is bolted to the outside of the box *h* by a flange, the end passing through and made to enter the cap *p*, through the hole *s*, as shown. The cap *p* is divided into two compartments by a partition *p'*, the object of which is to cause the steam to traverse through two sections of pipes. More partitions may be introduced, or any other arrangement may be adopted to insure full and equal distribution of the steam to each pipe. At *t* is shown a pipe connected with the lower side of the cap *p*, which passes through the box *h*, having a tight joint where it comes out. This pipe terminates in a pump *u*, the use of which is to pump away the water resulting from the condensation of the steam, and which collects in the bottom of the pipes and caps. At *w* is an opening in the lower division of the cap *p*, which forms a passage from the pipes to the interior of the box; the use of which will be described more fully. This opening, *w*, is to have a door or valve over it of common construction, which may be opened or closed by a handle from the outside of the box *h*, the handle working through a stuffing-box in *h*.

I have described this part of my invention as being made of tubes or pipes chiefly; but it is obvious that other forms may be substituted,—as sheets of metal, coils of pipe, &c.

The operation of this part of my invention is as follows:—The engine being started in the usual manner, the exhaust steam flows through the pipe s^1, into the cap *p*, and thence into the cluster of pipes *n*; at the same time a jet of cold water is admitted through the injection cock *o* on the perforated plate *m*, from which it falls in a shower upon the pipes *n*, and thus, by a well-known law, at once condenses the steam—the water resulting being collected in the bottom of the pipes and caps—the large pump *l* removing the condensing water as fast as it accumulates from the box *h*, and maintaining the vacuum,—the smaller pump *u* removing the water resulting from the condensed steam. In like manner, the condensing water is allowed to flow off as fast as discharged from the pump *l*, but the water taken from the pipes is retained for the feed to the boilers. The use of the aperture *w*, is for the purpose of maintaining an equal pressure on each side of the pipes, or rather to prevent them from being subjected to any pressure, either internal or external. This can be made apparent as follows:—Supposing the orifice *w* closed, and cold water admitted in quantity sufficient to condense a part of the steam only, it will be evident that the vacuum in the box *h* will be better than the vacuum in the pipes, and the difference will be as the volumes of uncondensed steam. Now if we open the door or valve over the aperture *w*, a portion of the steam in the pipes will at once rush through and extend itself throughout the box *h* until an equilibrium is produced. So long as the steam is fully condensed, and also the operation of the pumps *l* and *u* equal, then, of course, the radiating condenser *n* will be subjected to the same pressure, both external and internal; or, rather, will not be subjected to any, even if the orifice *w* be kept closed. The use of the opening *w*, therefore, is to insure the preservation of the equilibrium in cases where the steam is not fully condensed, or where the pumps fail to work equally. The atmospheric pressure being sustained by the box *h*.

Having now described the principal elements of my condensing apparatus, except some of its modifications (to be mentioned hereafter), I will next describe an apparatus for making up any deficiency in the supply of pure water which may arise from leaks and other means of waste. At *x*, figs. 1, 2, 3, is seen a tank, standing upon the top of the condensing box *h* (but may be put in any other convenient place). This tank must be air and water-tight, and also capable of sustaining the pressure of the atmosphere. At *y* a steam pipe is attached, which may terminate on the inside in a coil or cluster of pipes, or other chamber for holding steam, as shown. The lower end of this coil terminates in a pipe, which passes out through the side of the tank at *y'*, and empties into another pipe, as shown. *z* is a pipe attached to

the lower side of the tank x, the opposite end of which terminates in the "hot well" of the air pump l, or other reservoir containing a suply of the water to be evaporated; z' is a pipe attached to the upper side of the tank x; it is bent so as to pass down through the top of the box h, to which it is bolted by a flange, the end terminating so as to discharge into the cap p of the inside condenser, as shown; z'' is a pipe attached to the tank x, near its bottom, by one end, and by the other to the box h, so as to discharge into it. To put this apparatus in operation, the engine is first set in motion, and the condensation of the steam going on, the vacuum of the box h will be communicated through z' to the tank x, the interior of which will consequently be in vacuo. The cock to the pipe z being opened, water from the hot well of the pump l will flow into x by the pressure of the atmosphere; the tank is to be filled sufficiently to cover the coil of pipes, or as seen at the dotted lines. Next, steam is to be admitted through y, the cock y' being kept closed (except when it is necessary to draw off the water which may collect from the condensation of steam in this place).

By this means the water in x will be vaporized, the vapour being drawn off as fast as it rises through the pipe z' into the condenser's cap p, and there condensed along with the exhaust steam from the engine, so that it serves to make up for the loss by leakage, &c., of the first supply. As this apparatus is of use only where the water for generating the steam is impure or salt, some mode is required for keeping the tank x clear of the deposit of these impurities, as by evaporation all these must collect in the evaporating vessel, according to laws well known. To remedy this, I connect the evaporating vessel with the box h by a pipe z''—said pipe entering the evaporator near its bottom, and discharging into box h, as shown. A cock or valve is also fitted into said pipe, to regulate the rate of discharge, which takes place by gravity alone, as the two vessels are alike in vacuo. The saturated water will flow through the pipe z'' in the same manner as if x and h were both open vessels. If the supply for waste is to be made up from salt water, as in seagoing steamers, then a certain quantity of this water must be taken out of the tank by this pipe proportionate to the quantity evaporated, and thus the amount fed through the pipe z must be sufficient for both the evaporation and the quantity thus drawn off. The same rule applies to evaporating water containing lime or any other impurity. The water taken off through z'' enters the box h, and is pumped out with the condensing water by the air pump l.

In fig. 5 is a view of a modification of the condensing apparatus—the same letters referring to the same parts, except where otherwise indicated. This is to show a mode whereby the radiating or surface condenser may be immersed in the condensing water, or showered at pleasure, and exhibits also a variation whereby the pump removing the water resulting from the condensed steam may be dispensed with.

In this case, when the pipes or other surfaces, n, are immersed in the water, they are subjected to the pressure of the same in a greater or less degree, according to its depth; but they are not subjected to the pressure of the atmosphere in addition, as will be shown. h' h'' represent two openings in h connecting the air pump l by the channel k. k' k'' are valves for closing the openings h' h'', operated from the outside of the box h, as shown. If the pipes n are to be used submerged, the valve k'' must be closed, and valve k' opened. The condensing water being let on through o', fills up the box h until the water is on a line with the opening h', and thus the pipes are immersed.

If the pipes are to be showered instead, then k'' must be opened, and the condensing water let on through o on to the plate m, in the manner before described. When this plan is adopted, the aperture for insuring the equilibrium must be placed in such a situation that the condensing water cannot enter the pipes; in fig. 5 it is shown at the pipe w', and w'' is the stop or valve for opening or closing it. The next feature is a method of dispensing with the pump u. A is a tank, air and water-tight, and capable of sustaining the pressure of the atmosphere. This is to be connected to t by a pipe, with a valve or cock intermediate, as t'. At t'' is a delivery cock; at t''' is an air cock. The pump u being disconnected, t' is to be opened, and thus communication is made between the tank A and pipes n, as plainly shown—t'' and t''' being closed always when t' is opened. The water from the condensed

steam will now descend by its gravity into A; when A is full, t' must be closed—t'' and t''' opened, which permits the water in A to run out, being collected in reservoirs, from which the boilers are to be fed. As soon as A is empty, close t'' t''', and open t' until again filled, and so on. The periodic opening and closing of these valves or cocks can be easily arranged to be operated by the works themselves.

Fig. 4 exhibits another arrangement, embodying however the same general principles. The same letters are used to represent similar parts, described in the other figures. The principal variation in the construction of this part of my invention, consists in forming the box *h*, so that the tubes *n* shall be inserted in the two opposite sides, as shown in the dotted lines. In that case the caps *p* and *r* to cover them, are placed outside. The injection-cock *o* is placed at the bottom, and the delivery-pipe *k* at the top, so that the pipes are shown as immersed in the water, but may be showered by making the changes before described. w''' represents a pipe forming a communication with the box *h*, and the interior of the pipes *n*, for keeping the pressure equal, and is equivalent to the aperture *w*, in fig. 3, or w' in fig. 5. Another variation consists in the manner of removing the water of the condensed steam, the same principle being applicable to removing the condensing water also. The pump *u* being taken off, a pipe a' is substituted which is attached to the cap *r*, where the water from the condensed steam accumulates. This pipe must have a descent vertically, sufficiently great to cause the column of water to counterbalance the atmospheric pressure (say of 34 feet), and may terminate in a reservoir. By this means the gravity of the water will overcome the vacuum in the pipes, and thus deliver itself without other mechanical aid.

I have thus set forth several modes in which I contemplate constructing, operating and applying my invention, and I will now state wherein it differs from all others, and the advantages to be derived from the same.

First, by arranging the radiating or surface condenser, so that it is not subjected to the pressure of the atmosphere. Secondly: By reason of which arrangement, the apparatus is not so liable to be destroyed by the great pressure it would otherwise have to sustain; therefore durability and safety is increased. Thirdly: Small leaks and fractures will not affect its operation; the box *h* being exhausted of air or other uncondensable gases, which are not therefore present to flow through such apertures and the condensing water will not enter, because there is no external pressure upon the pipes, to force it in; the water falling upon the pipes by gravity alone, its tendency will be to run out rather than in. Thus, where salt or other bad water is used for condensing, no admixture with the pure water of the condensed steam will take place. Fourthly. Increased safety; as the whole surface condenser might be destroyed in the box *h*, without impairing the working of the engine, or even arresting its motion. The only change perceivable would be the loss of fresh water, resulting from the condensed steam. This is a most important feature for seagoing steamers.

In the foregoing specification I have described the apparatus, arranged generally, so that the condensing water is applied to the exterior surface of the pipes, or radiating condenser; and although I prefer this plan, yet a slight change can be made, whereby the condensing water shall be applied on the inside of the pipes or surface condenser, and the steam injected in the box *h*, the pumps *l* and *u* being in that case transposed to suit the arrangement.

Having now explained fully the nature of the invention which has been secured to me, and having also described the best method with which I am acquainted for carrying the same practically into effect, I wish to declare that I do not intend or mean to limit myself to the precise forms of construction or arrangement of parts set forth herein, as these will doubtless require to be varied to suit the particular nature of each application, and without departing from the nature and object of my invention, but that which I consider to be new, and therefore wish to claim as the invention secured to me by the aforesaid letters patent, is—

Firstly.—The combination of a surface or radiating condenser with a box or case, in such way that the condensation of the steam shall be effected therein without subjecting the said radiating condenser to atmospheric pressure in the manner described.

Secondly.—I claim the aperture "*w*," or its equivalent, for maintaining the

equilibrium, and as a passage for any steam which may remain uncondensed within the radiating condenser in the manner set forth.

Thirdly.—I claim connecting the evaporator with the chamber in which the vacuum formed by the air-pump exists, for the purpose of enabling me to draw off the saturated water from the evaporator substantially in the manner described.

ON THE PRINCIPLES OF HYDRODYNAMICS. BY ALEXANDER Q. G. CRAUFURD, ESQ., M.A., OF JESUS COLLEGE, CAMBRIDGE.

Two centuries have elapsed since Torricelli discovered the relation between the rate at which water is discharged from a reservoir and the elevation of the surface of the water above the orifice. He showed, in a work published in 1644, that the velocity of the issuing stream is proportional to the square root of the pressure. It does not appear that theory has since done much for the science of hydraulics. Much learned labour has been bestowed on the subject; yet if we refer for information concerning it to the most modern and perfect treatises on rational mechanics, we find little more than generalizations which have no application, hypotheses inconsistent with themselves, and formulas at variance with facts. Some indulgence may, therefore, be reasonably hoped for, by the author of any new attempt, and men of sense may be expected to receive with favour those methods of investigation which, though they do not flatter the imagination by attempting impossibilities, are found to reward the labour of study by intelligible and useful results.

Those six equations which are commonly called the "Equations of Movement of a Solid Body," are, as is well known, applicable to the movement of any system of particles whatever, provided these are subject to the law of action and reaction. I have shown, in the *Mathematician*, vol. iii., p. 5, how they may be derived, by a very simple calculation, directly from this law, and the equations of movement of a single particle. When a system of particles is invariable in form, there are but six data necessary for determining its position—viz., the three co-ordinates of its centre of gravity, and the angles which determine the position of the three principal axes passing through it. These being known for any given epoch, they may be determined as functions of the time by the integration of the six equations of movement; which, therefore, are sufficient, in all problems relative to a solid body, for the complete determination of the movement of every particle of that body. When the movements of a fluid are the subject of our researches, this complete solution is scarcely to be expected. Fortunately it is not required for any practical purpose. When water issues from an orifice, or is discharged through pipes, all that is commonly required to be known is, "How much water will be thrown off in a given time?" and "What will be the velocity of the issuing stream?" But chiefly the former. The reservoir and the water in it constitute a machine; the moving power is gravity, and we want to know how much work per hour, or per minute, this machine will do. A single equation suffices to determine this; and the following is the method by which, with the aid of it, I arrive at that solution of the problem of issuing fluids, of which I gave the result in a former Number of this Journal, March 1850.

A mass of water is contained in a vessel, and while a small quantity escapes by an horizontal orifice in the base, the waste is supplied by water gently flowing in at the top, so that the height of upper surface above the base is kept constant. The height h, and the area of the orifice a, being given, it is required to calculate the discharge q in a given time. The following is the equation which I employ for the solution of the problem:—

$$\Sigma\, m\frac{d^2x}{dt^2} = \Sigma\, P \cos\alpha$$

(see *Mathematician*, vol. iii., p. 5). When translated into common language, this equation reads thus:—"The *actual* rate of producing or generating moment in any given direction is equal to the

potential rate of generating moment in the same direction."

Definition.—By the potential rate of generating moment in any direction, is meant the sum of all the rates of generating moment in the same direction, due to each force, if it acted independently. The mass to which we apply this equation in the present instance, is the water in the vessel, and the forces with which we have to do are those which act in a vertical direction. The principal of these are gravity and the reactions of the sides of the vessel. The atmospheric pressure at the upper surface is balanced by that exerted at the orifice and by the reactions, so that no moment is due to this force. There is a retardation due to the friction of the issuing stream against the orifice, perhaps also to the adhesiveness of the water to the sides of the vessel. Of these, which may be considered as slight disturbing causes, we shall take the former into account when we have first shown what conclusion we arrive at when it is neglected, as it has been by all preceding calculators.

Let p denote the pressure on the base, referred to unity of surface, due to gravity and the motion. If a piston were suddenly applied at the orifice, so as to stop the motion, it would sustain a pressure equal to pa, and would exert a reaction equal and directly opposed to this pressure. Therefore pa represents the resultant, or sum, of all the vertical forces; or the potential rate of generating moment in a vertical direction.

In order to estimate the actual rate, we require to know the area of a section of the issuing stream, at a part where every particle has the same vertical velocity. This is supposed to be the case at a very small distance below the orifice. Let a^1 denote the area of a section at this part, which is well known as the *vena contracta*. And let u denote the velocity at the *vena contracta*. Then ua^1 is the quantity of water which escapes in one second, the second being assumed as unity of time. And u^2a^1 is the moment generated in one unit of time, or the actual rate of generating moment;

$$\therefore\ pa = u^2a^1 \ldots\ldots (1).$$

If there were no movement p would be equal to gh; g denoting the rate of acceleration due to gravity, or, as we say, the force of gravity. And since a is supposed to be very small in comparison to the dimensions of the vessel, the motion of the water in the vessel will be slow, and p may be supposed not very much greater than gh. Assume

$$p = gh(1+\delta),$$

and our equation becomes

$$gh(1+\delta)a = u^2a^1,$$

$$\therefore\ u = \sqrt{\frac{a}{a'}}.\sqrt{1+\delta}.\sqrt{gh}.$$

And if q denote the discharge in a given time t,

$$q = ua't = \sqrt{\frac{a'}{a}}.\ \sqrt{1+\delta}.\ \ at\sqrt{gh}.$$

Let

$$\frac{a'}{a} = c^2,$$

and

$$\sqrt{\frac{a'}{a}}\sqrt{1+\delta} = m.$$

Then we have

$$\left.\begin{aligned} q &= mat\sqrt{gh}, \\ \text{and}\quad p &= \frac{m^2}{c^2}\,gh \end{aligned}\right\} \ldots\ldots\ldots\ldots (2).$$

It is well known that c^2 is nearly constant and equal to $\frac{5}{8}$. We may also assume δ to be nearly constant; for that part of the pressure which results from the motion may be supposed to be nearly proportional to the square of the velocity, and therefore *nearly* proportional to gh.

These suppositions being admitted, the first of equations (2) is equivalent to the common formula—(*See* Poisson, *Mècanique*, No. 676). But his method of investigation labours under two serious defects: viz., 1st. That the hypothesis of the parallelism of the slices is absurd, for if the horizontal sections of the vessel are unequal it is impossible for a fluid to move through it, while all the particles of each section have the same vertical velocity. 2nd. That the correction due to the contraction of the vein implies that all the particles at the orifice have not the same vertical velocity, which is contrary to hypothesis.

A much nearer approximation is obtained by taking into account the friction at the orifice. I suppose it to be proportional to the square of the velocity, and the measure of it to be $f^1\beta u^2$; where β represents the perimeter of the orifice, and f^1 is a co-efficient to be deter-

mined by experiment. It may be objected that u is the velocity at the *vena contracta*, not the actual velocity of the water in contact with the sides of the orifice. But I suppose that these two velocities bear a constant ratio to one another, as the area of the *vena contracta* does to that of the orifice.

Our equation will be

$$pa - f^1 \beta u^2 = a^1 u^2,$$

or $$gh(1+\delta)a - f^1 \beta u^2 = c^2 a u^2;$$

$$\therefore gh \frac{1+\delta}{c^2} = u^2\left(1 + \frac{f^1}{c^2}\sigma\right). \quad \sigma = \frac{\beta}{a}.$$

$$\therefore u = \frac{\frac{\sqrt{1+\delta}}{c}\sqrt{gh}}{\sqrt{1+\frac{f^1}{c^2}\sigma}}, \text{ and}$$

$$q = u\,a^1 t = \frac{atc\sqrt{1+\delta}\,\sqrt{gh}}{\sqrt{1+\frac{f^1}{c^2}\sigma}},$$

$$= \frac{nat\sqrt{gh}}{\sqrt{1+f\sigma}}.$$

If

$$\frac{f^1}{c^2} = f, \text{ and } c\sqrt{1+\delta} = n.$$

This is the formula which I gave in No. 1387 of the *Mechanics' Magazine.* I there showed by examples its practical superiority over those in which the friction against the sides of the orifice is not taken into account. I will venture to express my confident hope that this method of investigation will be found to possess a still greater theoretical superiority to all those which have hitherto been employed. This I shall endeavour to establish in a future Number of this Journal, by the solution, according to the same method of other hydrodynamical problems.

BAIN'S ELECTRIC TELEGRAPH.

It was announced some time ago that an arrangement had been made by the French Government for establishing this telegraph on the line between Paris and Calais. It was the intention of the Government to make, preparatory to negotiations with Mr. Bain for the purchase of his patent for the whole of France, an experiment on the line in question; but as the wires throughout the line were not in a proper state, it was subsequently resolved to try the system on the line to Tours. Two beautiful machines (made by M. Chevalier from Mr. Bain's models), have been appropriated for this purpose; one is at the Ministry of the Interior, the other at Tours. We were present a few days ago when a despatch by this telegraph was received from Tours, and the details respecting it may interest our readers, as showing the wonderful perfection to which the transmission of despatches has been brought by this last invention. A signal was made from the Ministry to Tours desiring that a despatch might be forwarded to Paris. This communication, and the answer from Tours, a distance of about 180 English miles, announcing that a despatch would be sent immediately, took one minute and a quarter. A long despatch, containing 466 words, equal to about fifty lines of the ordinary print in a newspaper, was then received. The time occupied in the transmission of this long despatch was only two minutes and a quarter. It was read off by one of the assistants, and written down by another at his dictation in thirteen minutes. The signs were read with the same facility and rapidity as another person would read the ordinary print of a book. Thus, if there were a telegraphic line on this system from Paris to London, the last message of the President of the Republic to the National Assembly might have been ready for composition in a London journal half an hour after it was read in Paris, as this time would allow for the preparation of the despatch in Paris for transmission. Mr. Bain's system differs entirely from that hitherto in use, for it is four times quicker for long dispatches than either of the systems which preceded it. It is called electro-chemical, as the dispatch is received on a disc of paper prepared chemically. The letters of the alphabet are represented by dots and lines, so arranged as for the key to be learned thoroughly by any intelligent boy or girl in less than a month. To prepare a dispatch there is a machine which makes holes or cuts according to the letters to be transmitted on a paper band of any length, according to the dispatch. This band, rolled round a cylinder, is placed upon the transmitting machine, and, when the machine is in motion, the paper runs off and the electric fluid passes through the holes and cuts, and, flying along the wire, the fluid, by means of a steel pencil or stylet, marks upon the prepared paper at the receiving machine dots and lines corresponding with the holes or cuts in the prepared message. These are read off with great rapidity, and the dispatch is written out by an ama-

nuensis. Whilst the first part of a very long dispatch is being transmitted, the remainder can be prepared and forwarded without interruption. In this way in the United States, where there are already 6,000 miles of electric telegraph on Mr. Bain's system, speeches in the House of Representatives, which fill two or three columns of a newspaper, are sent off as the speakers proceed. An attempt has been made to compete with this system, as to time, by a very ingenious printing apparatus to print the signs in letters as they are received, and thus save the time required by Mr. Bain's system for reading and writing out the dispatches. This plan, however, has failed in consequence of the frequent derangement of the machinery, which is necessarily both delicate and complex, whereas that of the electro-chemical telegraph, notwithstanding the rapidity with which it works, is of the greatest simplicity.—*Galignani's Messenger.*

INDUSTRIAL EDUCATION.

Sir,—The article on Industrial Education in your Magazine, No. 1431, having been forwarded to a very distinguished member of the House of Commons, who had long advocated the education of the people, he was pleased to favour the author of that article with valuable remarks upon it,— amongst others, several on the enunciation that religion should form the basis of education. It appears that, from the ambiguity of my expression, he conceived it to be intended that the secular schoolmaster should be the tutor of religion; and as the same misconception may lead others to deprecate the plan of industrial education altogether, from its apparent want of liberality, I beg leave to enclose a copy of my reply to that gentleman's observations, hoping that, at your convenience, it may be favoured with a place in your columns.

As in that reply, by way of elucidation, some places and persons were spoken of by name, I have taken the liberty of suppressing those particulars in the copy enclosed, as also many expressions of thanks, though in every other respect the copy is an exact one of the original.

Other remarks on industrial education have been bestowed upon me; one of them from a gentleman of known sound judgment and great observation, seems to call for attention and farther investigation; it is that, "At all events it seems expedient that those who are taught in England should receive some education different from what the lower classes obtain in Germany; for there, though education of some sort is universal, and indeed compulsory, it seems they come out a very indifferent set of people in intellect, morals, and religion." I am, Sir, yours, &c.,

M. S. B.

"I have, indeed, to regret that my paper should suggest the notion, that the schoolmaster was intended by me to usurp the duty of the clergyman; such an interference was the farthest from my thoughts. Reluctance to enter upon the mode of imparting religious instruction, induced me to state generally only that it should form the basis of education; and I plead for pardon in now troubling you with some details of my conceptions on the subject.

"In the first place, it appears to me that, whilst the State professes to tolerate every variety of religious evidence, the utmost freedom should be accorded to parents as to the faith and mode of worship in which their children should be reared. Piety I believe to be the fundamental feeling in all sects of Christians, however much they may differ one from the other in doctrine or in ceremony; but tolerant as are my own opinions, I see that most persons who really are religious, consider that their own persuasion is the safest, the truest, and the best. We have here . . . . . no less than seven distinct sects, who have each of them its separate church or chapel; and not any one of these sects would willingly consent to the teaching of its children in any other way than according to the faith and forms of its own particular plan of worship; hence I could not but be aware that any attempt to give the same religious instruction to children of so many different sects as there are in the kingdom would prove abortive, and that it has been, as you observe, 'the *error* on which *all* the suggestions made by the advocates of general education have hitherto been wrecked.'

"In the industrial schools I have ventured to propose, it does seem to me that, by some means, instruction in piety and in morality, as well as in secular attainments, should be provided for; and so far as my own experience and obser-

vation enable me to hazard an opinion, it would be, that the religious instruction should be given by the clergy, and that on the Sunday; besides, in most cases, on some other day of the week, as might be determined on—the pastor of each persuasion affording it, not at the school, but at his own church or chapel, and to the children of his own congregation. This is but copied from the practice of Protestants, I believe, very generally in France; I know it to be so at Paris and at Montpellier. At the latter town, the time chosen is the interval between the morning and evening Sunday services, during which interval there is what is called the '*Service des Enfans ou Ecole de Dimanche.*'* The pastor himself, after prayers, suited in length as in other respects to his juvenile congregation, gives a short sermon also suited to young capacities and needs: this service ended, the children divide into classes, and religious instruction is given in each class by voluntary teachers approved of by the pastor, and under his immediate superintendence—he himself taking a class, or giving only general supervision, as he thinks most advantageous for the pupils. Objections may be started to any and every plan; but this mode might probably be found efficacious and little liable to cavil. Parents would, of course, send their offspring to the place of worship most conformable to their own opinions; pious and moral teachers would, by their individual exertions, secure the attendance of many children who might otherwise refrain from it; and the instruction being given in a sacred edifice, would most generally be found to inspire more suitable thoughts and to make a more forcible impression than if received in an ordinary schoolroom. It has been very generally remarked that the customary attendance, required from children on Sundays at schools, followed immediately by the church service for adults, is of too long and continuous duration for the juvenile temperament, especially for children of tender years; and unhappily it has not unfrequently been found that disgust for even religion itself has been the result. Would it not then be more profitable in childhood to refrain from enforcing on it a presence at services of long duration, and to lead them to love, instead of to dread, their lessons on religion and morality, and their church itself?

"It is, I must confess, extraordinarily presumptuous thus to detail such projects to *you*, Sir; yet peculiar circumstances may have afforded me better opportunity than you can have had, of looking into the interior of domiciles of the industrious, and also into those of so many of the lower classes who might be termed *non*-industrious. Here, in a parish of eleven or twelve thousand souls, the habits of perhaps half the number may have come under my observation; this has assured me that the very lowest orders, if left entirely to themselves as to religious and moral instruction, would for the most part altogether neglect it. Some mothers would be too ill-informed to instruct a child—others too idle to get their children ready for attendance elsewhere to receive it, if it were not in a manner obligatory: were it on this account alone, it would seem that the most practicable means of ensuring the attendance of children for such instruction is, that of confiding to voluntary teachers, male and female, the task of inciting both parent and child to seek it, to value it, and to profit by it.

"The 'Service des Enfans' in the French Protestant Church is for *all ranks* of children, the highest as the lowest. All sects of Christians profess that all ranks are on a level in the sight of the Almighty, and that the religious and moral teaching to all should be the same; no objection could be made then, to the assembling together of all ranks for this purpose; although it may be doubted whether it would be advisable to give secular instruction in the same place, and of the same description, to different ranks in society—to the pauper, the ragged scholar, the child of the self-supporting artizan or agricultural servant, and even of higher grades of society, as seems to be implied in the Manchester scheme. It might, on the contrary, prove best that those of the ragged school should receive such education only, as would enable them to earn a livelihood in the lower descriptions of employment, whilst to the child of the worthy self-supporting man, more extensive knowledge should be imparted. For example; the first four rules of

* Service for children, or Sunday-school.

arithmetic are abundantly sufficient to enable the tiller of the ground to keep an account of his little receipts and expenditures, whilst overseers and mechanics in the prosecution of their respective employments, would find use for the higher rules—not, that remarkable aptitude in even the very lowest of children should be debarred from the elevation which in this country genius often acquires for itself. Sir Samuel Bentham, in his arrangements for a naval seminary, provided for such cases. He proposed that half yearly, a certain number of children of the inferior class, on proof of distinguished merit, should be raised to the middle class; and again, some of that class to the highest one. In a populous town, by a mixture of different descriptions of the working classes, it seems much to be feared that the superior children would be degraded in their habits rather than that the latter would be elevated in theirs. Seated beside the filthy ragged boy, the neatly-dressed cleanly one would, by dint of being forced to tolerate dirt and rags in a neighbour, lose his distaste for untidiness and stench. The moral effects of a general mixture of virtuously-reared children with depraved outcasts of society, do not seem to have been sufficiently considered; but it may be dreaded that, spite of the most careful supervision, the good would lose more than the bad would gain by such an intermixture. It seems to me, however, that it is the improvement of the idlest, the poorest, dirtiest, and most depraved which stands most in need of the intervention of benevolence, and even Government itself; that it is by the amelioration of this description of children that society at large is most called upon to act. Is it at Aberdeen that a late general seizure was made of all young vagabonds, taking them per force to school? Wherever it was, the result was said to be most happy—the urchins were reformed.

"How is it proposed in the Manchester scheme to enforce the attendance of children at school? Can it be done without an Act of Parliament? It might be that were schooling provided for all by a public rate, independent parents and the well-disposed of humbler classes would be likely to avail themselves of the benefit, but that the vicious or idle parent would still continue to let his children prowl about the streets—unless, indeed, as is the case in some existing gratuitous schools, the parents were *bribed* by money, or by money's worth, to send their imps to school. "Do you think," said a woman, "I will send my girl to school when they give only shoes and stockings once a year for going?"

"The keeping children out of mischief is of itself a great good, and so far, whatever may be taught in a school is beneficial; but in the very lowest ranks, no less than in many higher ones, the most permanently useful worldly instruction is doubtless that which most tends to future honest acquirement of money by labour or by skill—money, as the general purveyor of comforts, of luxuries, of bread—reading, writing, and arithmetic, as *subservient* to other acquirements, are desirable for all; but it is *industrial* education that appears to stand paramount amongst *desiderata* when a plan of education for the labouring classes is in question.

"That some fund must be provided for the education of the very poor seems undoubted; but I cannot waver in the idea that gratuitous education, like most other gratuitous permanent assistance, is degrading to the recipient. Long-continued disease, the effects of hurts, and some other unavoidable misfortunes, in truth, sometimes disable the most prudent from educating, or even supporting, his children; in such distressing cases it is for *private* benevolence to lend its aid—private individuals who may know, or can inform themselves of each particular cause of inability. To the widow particularly, the paying the weekly schooling of her child, might often be a true and harmless charity. But the self-respect which it is so desirable to encourage in the industrial part of our population, can only be supported by bending them to depend upon themselves alone for the education of their children as for their daily bread.

"The ideas expressed in my paper were imbibed in a school which you well know had the benefit of the multitude at heart—that of Jeremy and Samuel Bentham. Accept my most grateful thanks for the observations you have bestowed upon me, and believe me to be, &c., &c.

"M. S. B."

ON MR. BILLS'S "EXTENSION OF HORNER'S METHOD."

Sir,—Mr. Bills has not responded to the call of "P. Q." at page 494 of your last Volume. I think that he will find the present a more difficult call than the one made by the same correspondent at a previous page (page 297) of the same Volume. With every respect for Mr. Bills's talents, it seems to me that his "Extension" is founded on mistaken views, both of the nature of the problem and of the appliances at our command for its solution. I regret this the more because Mr. Bills has talents that, if properly cultivated and judiciously employed, will do him high credit. That Mr. Bills should think the Horner-process is extended by writing a compound term for a single one, as that by which the roots of an equation are reduced, is to me very extraordinary; as it also is that he should not know that the efficiency of this method had been tried already. In fact, it could scarcely escape the notice of any one who was carefully looking at the subject; but I believe the general conclusion arrived at by algebraists has been, that little or no *practical* use can be made of it. At any rate, the investigation must be carried considerably further than this initial step, to be rendered efficient.

In some notes on Mr. Cockle's "ANALYSIS OF THE THEORY OF EQUATIONS" (in the third series of the *Philosophical Magazine*, p. 366 of the 32nd volume), the late lamented and illustrious geometer, PROFESSOR DAVIES, suggested the analysis of the equation by means of taking its roots of the form $a \pm \beta$; and in a subsequent short paper in the same work (*Ib.*, p. 347, vol. 34), Professor Davies showed that the two equations of Lagrange $X=o$, $Y=o$ legitimately followed without at all considering whether β was real or imaginary. The publication of this suggestion was contemporaneous with that of Mr. Cockle's "Analysis," and some time after Dr. Rutherford published a tract on the subject. His principle is the same as that of Professor Davies, the only difference being notational—Dr. Rutherford using

$$a \pm \sqrt{-\beta}$$

instead of Professor Davies's $a \pm \beta$. Of course, both arrive at tantamount equations, viz., those of Lagrange. Beyond this the ground is Dr. Rutherford's own, and he has perfectly succeeded in the application of Horner's method to the case of approximating both to a and to β. These, however, are *separate operations*. The equation $X=o$ involves only a, which is essentially real; and the equation $Y=o$ involving both a and β, of which a is now known, is capable of precisely the same treatment. It is in the application of the principle to *examples* that Dr. Rutherford's essay has been successful, and *stands alone*. All else had been done before. If I am not mistaken, Mr. Bills has seen the tract here referred to; and if so, his publishing the paper in question is the more inexplicable—at least his introductory remarks are so.

It is, indeed, to be admitted that there still stand difficulties in the way of this solution; but they are not of a kind that Mr. Bills seems to have foreseen. This especially: that there are n values of a, all real, given by $X=o$; and for *each of these* there are likewise n values of β. [The equation itself being of the $(2n)$th or $(2n+1)$th degree.] How, then, are the a's and β's to be assorted in pairs to give the true roots? Even if it should turn out and be proved that the equation $Y=o$ is the same for all the values of a deduced from $X=o$, this difficulty still remains; but in the present state of the problem, both are sources of embarrassment; both must be removed before the solution is complete.

Professor Davies has stated, that, amongst Mr. Horner's MSS. there are some sketches or attempts to frame trinomial divisors for the purpose of solution. This, in fact, is tantamount to the synthetic division of the original expression by $x-(a+\beta)$ and $x-(a-\beta)$ contemporaneously; or, in other words, by $x^2-2ax+a^2+\beta^2$ at one operation. I could not gather that he had any idea of being successful. Those papers are now in the hands of Professor De Morgan; and sure I am that if any man living can get any distinct idea of Horner's view of the subject from them, he can. The difficulty here, as in so many other cases of approximation, consists in finding the *initial figures* of a and b in the expression x^2+ax+b, which shall render it an exact or approximate divisor of the given

equation. Mr. Bills does not touch upon this point at all, yet Horner has left the problem already in such a state as to render this the *only difficulty to be dealt with.*

But even whilst as regards Mr. Bills's own proposal, this essential condition is thus set aside, it is by no means clear what his actual mode of working is intended to be. What "arrangement" does he mean? He describes none—he gives no example. In the first place there is no obvious necessity for the multiplication by the congeneric surd; and in the second that (in his apparent way of using it) it would not be legitimate, inasmuch as it would be equivalent to reducing the roots by $\alpha^2 - \beta^2$ instead of $\alpha + \beta$, or, in his notation, by $r''^2 - s''^2$ instead of $r'' + s'' \sqrt{-1}$. The passage, however, is ambiguous, and I may not have caught his meaning.

Were we, however, to grant everything to be straightforward and unobjectionable thus far, there is yet the question of approximating to his r and s *at once.* He has not shown that this can be done, though he asserts it plainly enough. I think this question may be in some degree tested by experiments upon any proposed equation, such as that at p. 297 of the last Volume, provided however that Mr. Bills will show us by a few examples how to arrange our figures. I have tried the process ove and over, and *always* with the same result. The next quotient figures of α and β are not truly (or often even approximately) given by it. This at once condemns it as a rule. In fact, the way in which a pair of imaginary roots is indicated by substitution, as lying between certain real limits of the decimal scale, has no *known* connection with the α, β of the roots themselves. It is not only a curious but an important inquiry: but one upon which I must not allow myself to dwell even in thought.

I believe that, many years before its actual publication, Professor Davies called the attention of his friend, Professor J. R. Young, to the subject of the process above mentioned, and he found that whilst it was familiar to Professor Young's mind already, he entertained no expectation of success from its use. Professor Davies never lost sight of his idea, as there are those perhaps who can testify. It undoubtedly is a good *working idea,* and very clearly indicated in his note (ϵ) to Mr. Cockle's "Analysis."

I here conclude with a hope that I have expressed myself so as not to give offence to any person whatever. I feel respect for Mr. Bills, and, as I shall not resume the subject and my hand will never wield the pen of controversy more, I trust that, although I do not further disclose myself, Mr. Bills and I part friends. Let me be referred to as

A RAY OF "P. Q.'S" LIGHT.

PAINE'S LIGHT.—EVIDENCE OF AN EYE-WITNESS.

Mr. Paine commenced turning the wheel in the Magneto-Electric Machine, and we all looked to see the gas arise from the *electrodes* in the jar of water, but no gas appeared. At length Mr. Ames discovered that one of the wires or copper ribands had been detached, or had not been screwed on to the wire at the top of the bell-glass.—This being corrected, Mr. Paine again commenced turning the machine, and instantly large bubbles of gas arose from the electrodes, and *filled the jar in less than a minute!* After taking out a stopper from the bell-glass, and allowing several jars-full of gas to escape, in order to expel the common air, and prevent an explosion, these were stopped, and the gas forced on through the gas pipe into the turpentine; and through this to the jet or burner. Between the jar of water where the gas was generated and the jar of turpentine, a jet issued from the pipe. This was lighted, and proved to be hydrogen gas. The flame, in front of a window, was so pale that it could not be perceived. We could see it by putting a dark body behind it. While this was burning, the gas was forced along through the turpentine to the other burner. A flame was applied to this, *and a brilliant light was shown!*

Here were two flames burning at the same time, from the same gas—the first, before passing through the turpentine, burning with a pale, almost imperceptible light, —the second, after passing through the turpentine, burning with a light superior to any gas that I ever saw before. When the magnetic machine was stopped, not a bubble of gas would appear in the jar, and the lights went out. This small machine generated gas enough to supply a dozen burners, any one of which I should think sufficient to light a room.

Now, it will naturally be asked, "Could not this tremendous electrical power which decomposed the water, be obtained from

some other source than the magnetic machine?" This question occurred to me before I saw the operation; and I determined, if possible, to satisfy myself upon the subject. I, therefore, with Mr. Paine's full permission, examined the table. I could easily see that no wires or pipes entered the glass jar of water, except the two connected with the magnetic machine. It was, therefore, to the magnetic machine that my attention was mainly directed. This machine I took up, and lifted it entirely away from the table—saw that no wires, pipes, or metallic substances whatever had any connection with it from the table. I placed the machine again on the table and turned the crank, and produced the gas in the jar, in the same manner and with the same success that Mr. Paine had done. Mr. Ames and Mr. Merrick did the same, and we were all satisfied; *perfectly satisfied that the water was decomposed by the electricity from the magnetic machine, and nowhere else.* To deny this, we must deny the evidence of our own senses. The gas was also produced faster, by a thousand—yes, ten thousand times, than we had ever seen it before by a similar apparatus! We had also the most positive evidence that the gas, after passing through turpentine, furnished a brilliant light. The gas produced *appeared* to be hydrogen—we judged by the smell and the burning; and yet *Mr. Paine said, although he called it hydrogen gas, it differed from the ordinary hydrogen.* I asked Mr. Paine why he interrupted the *positive pole* by the glass of water—why he cut this wire in two, and placed the ends in the glass of water? He said that unless this was done, both *hydrogen and oxygen* would be generated in the bell-glass; but that by this means he only obtained the hydrogen. There appeared to be no oxygen generated by the operation.

As to the amount of turpentine consumed by passing the gas through it, it was impossible for us to determine in the short time—an hour; we were engaged in generating and burning the gas. Mr. Paine stated that the gas was not *carbonised*, but was *catalized* in passing through the turpentine, and there was no loss to the turpentine by the process. Several gentlemen of high standing in Worcester, a few days previous to our visit, purchased at a store a small quantity of turpentine, measuring it accurately; which they took to Mr. Paine's establishment, and passed the gas, produced by three sets of magnets, through it for several hours, lighting the whole of Mr. Paine's house. The turpentine was again measured at the close, and found to have lost but a tea-spoonful—only as much as would be lost by evaporation and by turning it from one vessel into another.—*G. Q. Colton.*—*Boston Transcript.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING FEBRUARY 6, 1851.

RODOLPHE HELBRONNER, of Regent-street. *For improvements in preventing the external air, and dust, and noise from entering apartments.* Patent dated July 31, 1850.

These improvements consist in glueing or otherwise fixing over the crevices at which the air, dust, and noise enter, rolls of fibrous materials, which may, if desired, be waterproofed by coating them with a solution of India rubber or gutta percha. An arrangement of apparatus for rolling the fibrous material is described in the specification. The end of the sheet is held between two wires, one of which has a pulley at its extremity, over which passes a cord to a second pulley, with a handle for giving rotary motion. When the sheet has been wound round the wires, they are withdrawn, and the roll is done over with paste to cause the parts to adhere, and to give it a perfect appearance.

Claim.—The method described of preventing air, dust, and noise from entering apartments.

JUAN NEPOMUCENO ADORNO, of Golden-square, gentleman. *For improvements in manufacturing cigars and other similar articles.* Patent dated July 31, 1850.

Claims.—1. A machine or apparatus for making Havannah, Manilla, and Mexican cigars and cheroots, which consists of an arrangement or combination of rollers by which the middle of the cigar is formed and enveloped in a leaf of tobacco, whether such machine be actuated by hand or mechanical means. The number of rollers (which are fluted, and should be of such a shape as to give the requisite form to the cigar) is six; four of these are fixed in the lower part of a block which constitutes the frame—the other two in the upper part, which is hinged, to admit of its being raised to introduce the tobacco for the middle of the cigar. The rollers are caused to revolve in the same direction by a fluted pinion, and thus the leaf which forms the covering is drawn in and wound around the middle portion.

2. Binding the ends of cigars and cheroots with silk, ribbon, or other suitable material, instead of using gum, to secure the wrapper or outside leaf to the body of the cigar.

3. An arrangement of apparatus in which steel washers or small circular saws are employed, for cutting paper or tobacco, or other material into strips or small pieces, to be employed in the manufacture of cigars, cigarettes, cheroots, and other similar articles. These saws or washers, which should correspond with the width of strip required, are mounted alternately on two spindles—the edges meeting in the manner of a pair of scissors. Opposite each washer the spindles are covered with leather, and to prevent the paper or tobacco adhering to the leather, a wooden scraper is placed underneath in contact with it. When this apparatus is actuated by mechanical means, a cover is provided to prevent danger to the person attending it.

4. A machine described, or any mere modification thereof, in which a press and punch are employed to supply to grooves or spaces provided for the purpose, a sufficient quantity of tobacco to form the middle of the cigar, the said compressed tobacco being afterwards enveloped in paper or tobacco leaf by the wrapping apparatus used in combination therewith. (The latter apparatus consists of several of those first described and so arranged as to present continuously a succession of sets of rollers, which receive the tobacco as released from the grooves, in a block, to which a suitable alternating motion is imparted by a wheel having teeth on half only of its periphery.)

5. The employment of revolving grooved cylinders, hopper, India rubber covered rollers, cutting-knife, folder, and folding apparatus, in the manufacture of cigarettes, whether used separately or combined with the wrapping apparatus, for making paper pipes, or tubes for cigarettes, or for enveloping them in a leaf of tobacco. A sheet of paper of the same width as the length of the cigarette is fed into the machine between the upper grooved roller and a roller covered with India rubber. It then comes under a knife, by which it is cut into strips. Upon each of these strips is then deposited from the hopper the required quantity of tobacco, and the strip thus covered is forced into a groove in the roller, where it is partially folded. In each groove there is a horizontal bar which, by coming in contact with a pinned wheel during the revolution of the roller, forces the partially formed cigarette out, and delivers it into a groove in the second cylinder placed underneath. Here the folding operation continues until the horizontal bar in the groove is struck by the pin wheel, and the cigarette removed into the third cylinder where the folding of the ends is completed. In this state the cigarette may be taken from the machine to be ornamented for the Spanish market. If intended for the French market, it has a paper tube or mouth-piece folded round it by the apparatus employed for that purpose, and is finally enveloped in a leaf of tobacco, thus presenting the appearance of a finished cigar.

Peter Fairbairn, of Leeds, machinist, and John Hetherington, of Manchester. *For certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton, flax, and other fibrous substances; also in constructing and applying models or patterns for moulding preparatory to casting parts of machinery employed in preparing, spinning, and manufacturing fibrous substances, and also in certain tools to be used in making such machinery.* Patent dated July 31, 1850.

These improvements, in so far as they relate to machines for opening, cleaning, spreading, scutching, and lapping cotton, flax, hemp, and other fibrous substances requiring these operations, consist—

1. In the adaptation of a shield or cover to such machines, by which the loose fibres of the material operated on, are made to pass over the grating and over the upper surface of the perforated cylinder, in order that they may be more uniformly spread over its entire surface, and also that the lighter particles of dust and dirt, together with seeds and other impurities, may be more effectually drawn off.

2. In arranging the lapping rollers one above the other, in combination with intervening calender rollers, and in supporting and guiding the lapping roller in a sliding rack or carriage, and in the application of antifriction rollers behind each axle.

3. In an arrangement of apparatus for stopping the drawing frame when the cards are full or partly filled with sliver. On the lower surface of the plate of the machine is fixed a bracket supporting a lever, the inner end of which is provided with a catch, whilst the other carries a basin. The spindle of the lower back drawing roller is provided with a worm, which actuates a transverse shaft having a worm pinion at the end opposite to that at which it is driven. This pinion gears into a wormed spindle placed above it and supported b the plate, and provided with adjustable side pieces or guides. A cylindrical wormed weight is dropped loosely on the worm spindle, the guides which prevent it from slipping off laterally having been previously adjusted according to the period at which the motion of the machine is to be arrested. The revolution of the worm spindle causes the wormed

weight to travel on until it falls into the basin, when the opposite end of the lever is raised, and the catch taking into a notch in the traversing bar, stops the machine.

4. In the application to gill rollers of two collars or flanges, to confine the sliver to the width of the roller, and thus dispense with the ordinary front guides. And

5. In the employment of two or more gill rollers and corresponding drawing rollers to act on the same length of sliver during its progress through the machine. Under this part of their invention the patentees describe a method of driving two or more spindles in throstle frames by means of an endless strap or band passing around two drums and the wharves of the spindles.

The improvements in weaving machinery comprehend, 1. A novel construction of break, consisting of a bent lever and star wheel, or inclined plane, for acting on the fly-wheel, and stopping the motion of the loom when the driving-strap is thrown off.

2. A mode of imparting motion to the yarn and cloth beams by driving clicks, actuated by the vibration of the swords of the loom.

3. Effecting a recoil of the yarn and cloth after a false shoot by removing the ordinary detaining clicks.

4. The application of friction surfaces to the driving of the warp and cloth beams, the said surfaces acting in conjunction with a regulating roller, or other apparatus in contact with the yarn or cloth.

5. The employment of a flying reed, which is retained in its working position by means of bolts capable of being withdrawn by the ordinary "protector" motion.

6. Making the forks of the weft detector apparatus of brass or other cast metal.

The improvements in constructing models for moulding, consist in dividing the model of the article to be cast into two parts in the direction of its widest plane. These parts are then affixed by pins or otherwise to the opposite sides of a plate or diaphragm, which is placed between the upper and lower halves of a core-box. Sand is then rammed hard into one half of the box, and a mould of half the article to be cast thus obtained. The box is now carefully inverted, and the other half mould obtained in a similar manner. The moulds must now be carefully lifted, and the plate removed; and when the gutters for the molten metal are made, and two parts clamped together, a perfect casting will be obtained.

The last branch of the specification includes a boring-machine, and a slide-lathe for boring cylinders, and for facing cylinders and blocks.

JOHN HYNAM, of Prince's-square, chemical light manufacturer. *For improvements in machinery for placing splints of wood, and wax, and composition tapers, in frames for dipping.* Patent dated July 31, 1850.

In the machine described and claimed by Mr. Hynam the splints of wood are first placed by hand in a feed-box, in the upper portion of the machine, whence they are forced to a second case beneath, and from this they pass to the frames, which are placed over a tray with longitudinal partitions to ensure an equal length of each splint projecting from the frame. The latter is furnished with sliding bars, one of which is placed between each row of splints. When the frame is full, the rows are clamped tight together, and are ready for dipping in the ordinary manner.

RICHARD ARCHIBALD BROOMAN, of 166, Fleet-street, London, patent agent. *For certain improvements in abdominal supporters.* (A communication.) Patent dated July 31, 1850.

Claims.—1. The employment of two short elastic arms, S-shaped, connected with other parts of a supporter, having a pad upon each end, one pad to rest upon the short ribs behind the curve, and free from the spine, while the other rests upon the flat plate of the *os illium*; each S plate being united at the middle to a long elastic arm by a mortise, allowing no motion but that of sliding in or out; the long arm and the short arm always crossing at right angles.

2. The employment of two long elastic arms in connection with other parts of a supporter, and with the S-shaped arms, by a mortise and screw-bolts, these arms being so cut that when laid upon a flat surface, the edges shall be first convex, then concave, and then straight; and formed so as to sit flat upon the person, rising above the hips with a point of rest about one-third of its length from the back, and falling down in front to a pad, and by so adjusting the shape of the arms and point of rest, as to press directly upon the hernial rings, and lift up the abdominal contents towards the top of the hips.

3. The employment of a supporter pad, so formed as to be thicker on the inside near its lower end and outer edge at the point of termination, or lower fastening to it, of the long elastic arms, so as to press directly on the hernial rings; the lower outer edges being cut so as to follow the course of the groin, and the lower edge yoked, or cut convex, to go above the *os pubis*, thus acting upon all those parts occupied by the abdominal rings.

4. Dividing of the front pad perpendicu-

larly through the centre, and connecting the parts by a hinge joint, and by straps rendering the parts adjustable to any desired position.

EDOUARD GABRIEL LEROY, of Paris, gentleman. *For certain improvements in locomotive engines, and in the means and apparatus to be employed for generating and condensing the steam to be employed therein.* Patent dated July 31, 1850.

The present improvements in generating steam in locomotive engines consist in employing for that purpose gases of the ordinary description used for lighting. The construction of the boiler is thus necessarily altered—burners being substituted for the furnaces. The patentee describes three methods of supplying gas to the burners. The first of these is, to have a main pipe, with branches from the works (which are to be erected in convenient situations near the line), laid down the whole length of each line of rails. This pipe has a slit or opening at the top, which is closed by a flexible continuous valve. The construction of the valve may be varied, and it may consist of a tube of flexible material slightly distended by compressed air, and enclosed within and closely fitting a perforated tube, which has a corresponding longitudinal opening, and is furnished with flanges, by which it is secured inside the main pipe, immediately below the longitudinal opening; or it may be simply a flexible lip valve, such as was invented by Hallette, of Arras; or it may be formed of two curved pieces of prepared leather or other material, kept in contact by the internal pressure of the gas. The feed pipe of the engine, situated in the bottom of the smoke box, is composed of two parts, with a telescope joint, the lower portion being pressed against the surface of the main pipe by spiral springs. There is also fitted to the lower part a roller, which, when the engine is in motion, acts on the flexible valve, and, by depressing it, allows the gas in the main to ascend into the feed pipe of the engine, whence it passes to the burners. Another method of supplying gas is, to have attached to the tender, a reservoir capable of sustaining the pressure of the gas and of containing a sufficient quantity to supply the burners from station to station. At every station, or as often as requisite, there would be cocks to the main for supplying the tender. The third method consists in combining these two systems, and supplying the tender at intervals from the main pipe, parts of which only would thus require to be furnished with a flexible valve. For condensing steam, it is proposed to employ a tube similar to that of the atmospheric railway, but of smaller dimensions, into which the waste pipe of the engine should lead, and thus effect the desired object. The water of condensation would require to be occasionally drawn off.

Claims.—1. Generating steam in locomotive engines by the combustion of gases generated or produced in suitable apparatus detached from the engine, and supplied to the engine by pipes or otherwise.

2. The method described of condensing steam.

MATTHEW TRATTLES, of Rochester, tool-maker. *For certain improvements in saw-sets, mallets, and other tools, and in apparatus and machinery for manufacturing the same.* Patent dated July 31, 1850.

Two specifications of this invention have been enrolled.

In the first, Mr. Trattles describes and claims,

1. A method of making the heads of mallets of iron, wedge-shaped pieces of wood being introduced at each end to receive the force of the blows.

2. The application of spiral or coiled files disposed around a roller of iron, like the thread of a screw, to the sharpening of files.

3. The employment of metal dies struck by a hammer, for setting two or more teeth of a saw simultaneously.

4. Making these dies of iron, hardened after the required form has been imparted to them.

The second specification comprehends,

1. An improvement in the manufacture of round and rectangular headed mallets, which consists of forming the head of a shell of iron, into which pieces of wood are inserted at either end.

2. An arrangement of dies for setting the teeth of saws.

3. The application of a file wound like the thread of a screw round a cylinder, or roller, to the sharpening of the teeth of saws.

4. A reciprocating saw sharpener.

5. A mechanical appliance to the mandril of a turning lathe, for turning handles for mallets and other tools of an oval form.

Claim.—The improvements described in saw-sets, mallets, and other tools, and in apparatus and machinery for manufacturing the same.

JOSEPH POOLE PIRSSON, of New York, civil engineer. *For certain improvements in steam machinery and apparatus connected therewith.* Patent dated July 31, 1850.

(For the Specification of this Patent see *ante* p. 102.)

HENRY RISHTON, of Kendal, plumber.

For certain improvements in water-closets and urinals. Patent dated July 31, 1850.

Claims.—1. The construction of water-closets in such manner as to dispense altogether with the ordinary cisterns and their appendages. This is done by attaching a flushing valve of peculiar construction to the service-pipe, by the opening of which water is simultaneously supplied to the basin, the scatterer, and trap. Several exemplifications of this method are given, and also several modes of constructing the valve.

2. The constructing of the basins of water-closets with recesses round the upper rim or edge, which serve the purpose of the ordinary service-box, and admit of either one or two scatterers being employed.

3. A peculiar construction of urinal, whereby the persons using the same shall, by their weight, bring the flushing apparatus into operation.

James White, of Holborn, mill-maker. *For certain improvements in machinery for bruising, crushing, and expressing juice from certain vegetable substances.* Patent dated July 31, 1850.

A full description of a machine embodying these improvements, with engravings, will be given in our next.

Joseph Shaw, of Paddock, near Huddersfield, cloth finisher. *For improvements in constructing and working certain parts of railways.* Patent dated August 3, 1850.

The improvements claimed under this specification are—

1. An arrangement of apparatus for actuating rising and falling shunts or points, and particularly the use of shunts working vertically instead of horizontally. The vertical shunts are attached to opposite ends of a rocking lever, and are elevated or depressed by means of cams, which are actuated by a system of levers connected by rods to bell-crank levers, one on either line of rails, which are set in motion by rollers or bowls on a transverse shaft in front of the engine. The shaft may be shogged laterally, so as to bring the bowls to bear on either lever, at the discretion of the engineer.

2. A method of rendering the ordinary points self-acting, and thereby preventing the passage of a train across the main and on to a branch line.

3. A method of working visible signals by the traverse of the engine itself. This is effected by the engine coming in contact with tumbling levers connected with a system of levers, and other mechanism, for actuating the signals.

4. A method of working audible signals, whether stationary or attached to the engine.

5. A mode of opening railway gates on a level where the railway is crossed by a common road. In the case of double gates fastened by a catch at the bottom, the friction rollers on the front of the engine come in contact with tumbling levers, which, through the intervention of connecting rods and levers, withdraw the catch, and permit springs at the opposite side of the gates to come into action. The gates thus receive a certain impetus tending to open them, which is completed by the falling of a weight attached to them by cords, and passed over pulleys on the gate posts. The tumbling levers must be situated at a sufficient distance from the gates to allow time for them to swing back before the engine comes up to them.

Specification Due, but not Enrolled.

John James Greenough, of George-street, Hanover-square, gentleman. *For improvements in obtaining and applying motive power.* Patent dated July 31, 1850.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Samuel Allen, junior, of Birmingham, manufacturer, for certain improvements in the manufacture of buttons. February 1; six months.

Nathaniel Jones Amies, of Manchester, manufacturer, for certain improvements in the manufacture of braid, and in the machinery or apparatus connected therewith. February 1; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in communicating intelligence by electricity. (Being a communication.) February 3; six months.

Alexander Alliott, of Lenton Works, Nottingham, engineer, for improvements in cleaning, dyeing, and drying machines, and in machinery to be used in sugar, soap, metal, and colour manufacturing. February 3; six months.

Benjamin Ledger Shaw, of Huddersfield, for improvements in cleaning and preparing wool and other fibrous or textile materials, and in the manufacture of coloured yarns of wool and other fibres, and in weaving. February 5; six months.

Angier March Perkins, of Frances-street, Regent-square, Middlesex, engineer, for improvements in railway axles and boxes. February 5; six months.

Charles De Bergue, of Arthur-street West, London, engineer, for improvements in and in the construction of the permanent way of railways. February 7; six months.

Frederick R. Robinson, of Bolton, Massachusetts, United States of North America, for a new and useful sewing machine. February 7; six months.

William Onions, of Southwark, Surrey, engineer, for improvements in the manufacture of certain parts of machinery used in spinning. February 7; six months.

William Onions, of Southwark, Surrey, engineer, for certain improvements in the manufacture of steel. February 7; six months.

François Marcelin Aristide Dumant, of Paris, engineer, for improved means and electric apparatus for transmitting intelligence. February 7; six months.

LIST OF SCOTCH PATENTS FROM 22ND OF DECEMBER TO THE 22ND OF JANUARY, 1851.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in cutting and dressing stone. (A communication.) December 23; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the manufacture of iron hurdles or fences, and of certain other articles in the construction of which ironwork is or may be employed. (A communication.) December 23; six months.

Thomas Allan, of Glasgow, Lanark, North Britain, ironfounder, for certain improvements in paving or covering roads, streets, and other surfaces of a similar nature. December 23; six months.

William Hodgson Gratrix, of Salford, Lancaster, engineer, for certain improvements in the method of producing or manufacturing velvets or other piled fabrics. December 24; six months.

James Nasmyth, of Patricroft, Lancaster, engineer, and John Barton, of Manchester, in the same county, copper roller manufacturer, for certain improvements in machinery or apparatus for printing calicoes and other surfaces, and also improvements in the manufacture of copper or other metallic rollers to be employed therein, and in the machinery or apparatus connected with such manufacture. December 24; six months.

Edward d'Orville and John Partington, of Manchester, Lancaster, manufacturers, for certain improvements in finishing thread or yarn. December 31; four months.

Thomas Brown, of Muscovy-court, Tower-hill, London, for improvements in machinery for raising and lowering weights. December 31; six months.

Francis Edward Colegrave, of Brighton, Sussex, Esq., for improvements in the valves of steam and other engines, in causing the driving wheels of locomotive engines to bite the rails, and also in supplying water to steam boilers. December 31; six months.

James Forster, of Liverpool, merchant, for improvements in filtering water. December 31; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Jan. 30	2654	Benjamin Goodfellow	Hyde	Fire-box and flue for cylindrical and other boilers.
,,	2655	Henry Dyer	Hungerford	Office index and memento,
31	2656	John Ezra Dalphin	Whitecross-street	Self-adjusting churn.
,,	2657	Henry Wickens	Regent-street	Border piece or edging for a parasol.
,,	2658	Pease and Gardner	Bradford	Pressure gauge.
,,	2659	William Levesley	Park-terrace, Old Ford	Guard razor.
,,	2660	John Chatwin Stokes	Birmingham	Tap.
Feb. 1	2661	Josh. Illingworth and Sons	Shipley	Adjustable eccentric tumbler for the slide valve of steam engines.
,,	2662	Negretti and Zambra	Hatton-garden	Metallic scale thermometer.
3	2663	John Gouger	Wood-street, Cheapside	Fastener for a shirt-collar, "The Imperial."
,,	2664	George Piercy Tye	Birmingham	Spring label for tree and flower-pots.
,,	2665	F. J. Brewer	Birmingham	Window.
4	2666	Benjamin Ridge	Putney	Invalid bed carriage
,,	2667	Auguste Bessan	Friday-street	Coffee-pot.
,,	2668	James Higgins	Salford	Roving or slubbing frame spindle.
5	2669	Archibald Kenrick and Sons	West Bromwich	Door chain and case.
,,	2670	John Groves	Wolverhampton	Day indicator.

CONTENTS OF THIS NUMBER.

Pirsson's Patent Steam Engine Condenser—Specification—(*with engravings*) 101
On the Principles of Hydrodynamics. By Alexander Q. G. Craufurd, Esq., M. A., of Cambridge 107
Bain's Electric Telegraph in France and America 109
Industrial Education. By M. S. B 110
On Mr. Bills' "Extension of Horner's Method." 113
Paine's Light—Evidence of an Eye-Witness 114
Specifications of English Patents Enrolled during the Week:—
Helbronner ..... Preventing Air-draughts, &c. 115
Adorno ..... Cigars 115
Fairbairn & Hetherington ..... Spinning, &c. 116
Hynam ..... Splints 117
Brooman ..... Abdominal Supporter 117
Leroy ..... Locomotives 118
Trattles ..... Saws 118
Pirsson ..... Steam Condenser 118
Rishton ..... Water Closets 118
White ..... Crushing Mill 119
Shaw ..... Railways 119
Specifications Due, but not Enrolled:—
Greenough ..... Motive Power 119
Weekly List of New English Patents 119
Monthly List of Scotch Patents 120
Weekly List of Designs for Articles of Utility Registered 120

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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Edited by J. C. Robertson, 166, Fleet-street.

WHITE'S PATENT CRUSHING AND EXPRESSING PRESS.

Fig. 1.

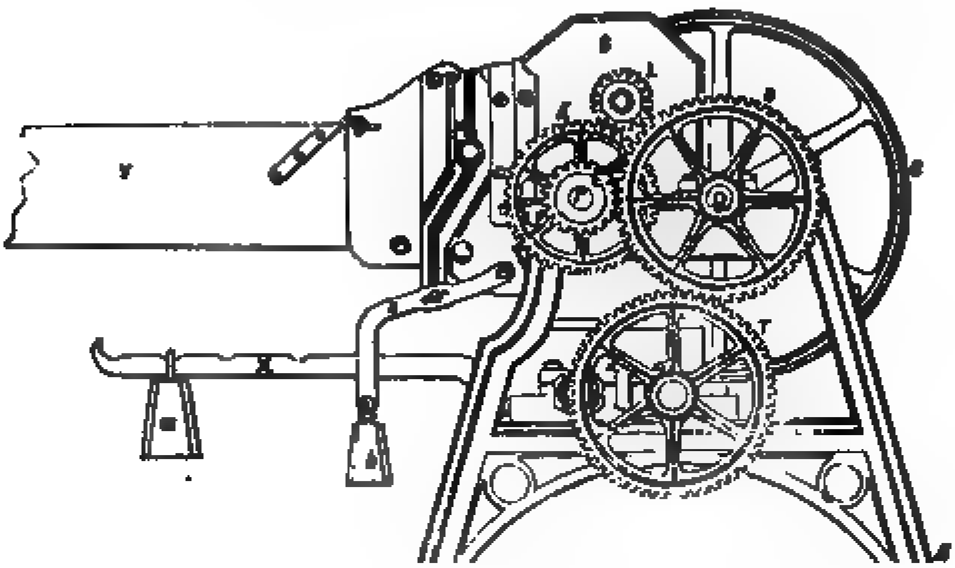


Fig. 2.

WHITE'S PATENT CRUSHING AND EXPRESSING PRESS.—(SEE ANTE, P. 119.)

Specification.

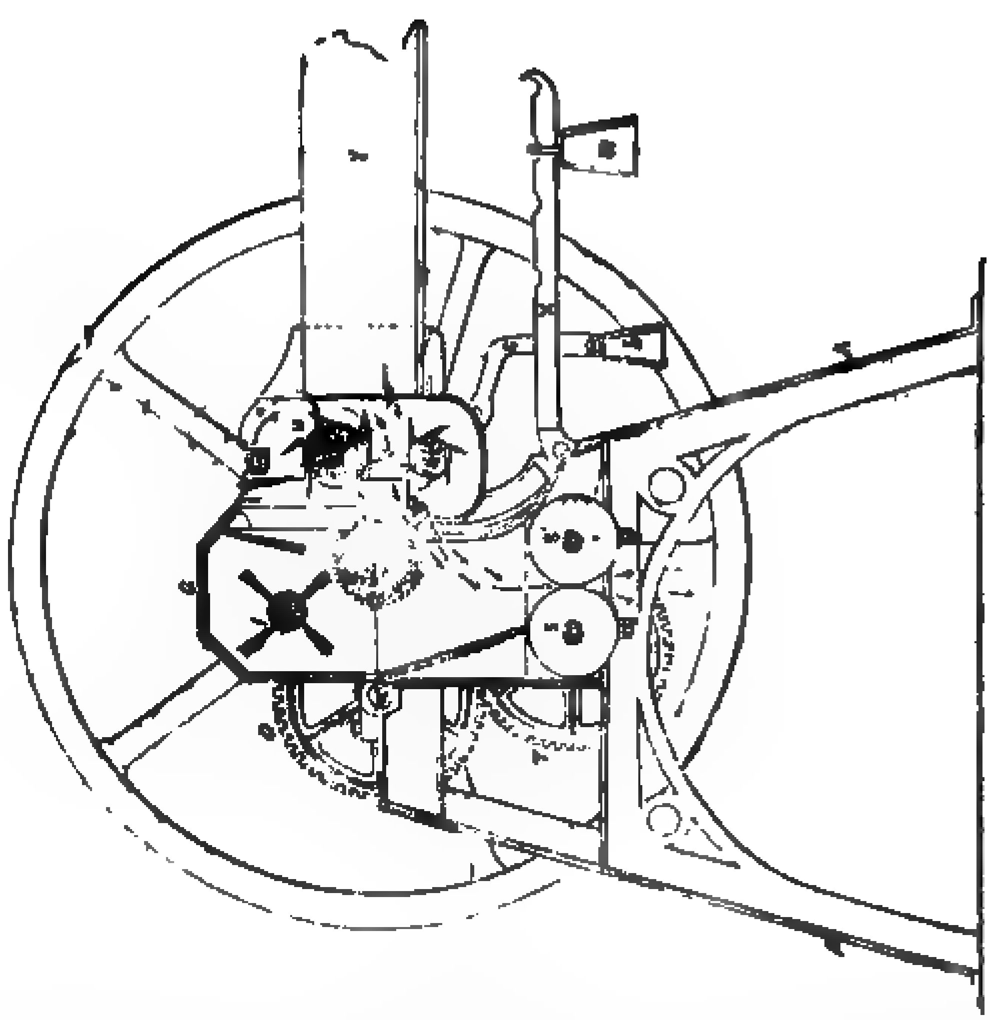
My improvements in machinery for bruising, crushing, and expressing juice are exemplified in figs. 1, 2, 3, and 4 of the engravings, which are views in different positions of a machine adapted for bruising gorse or furze for the use of cattle, for rasping potatoes for the manufacture of potato flour, or for the expressing of the juice from apples and beet-root in the manufacturing of cyder and sugar. Fig. 1 is a front elevation, fig. 2 a back elevation, fig. 3 a longitudinal section, and fig. 4 an end elevation. A A is the general framework of the machine; B is the main shaft; C is a pulley on the main shaft, through which the power from some prime mover may be applied to give motion to the machinery, or (should manual power suffice to work the machine) it may be applied to the main shaft by a crank handle. D is a wheel affixed to the main shaft, which gears into a pinion E on the spindle F; G is a box or case on the spindle F, within which there is fixed a circular rasp or saw-toothed roller H; this roller is composed of a series of thick circular saws, between every two of which there is interposed a plain disc of metal of about one-quarter of an inch i ickness, but of so much less diameter that the teeth of the circular saws project beyond the peripheries of the plain metal discs—besides which, the teeth of one saw are placed opposite to the spaces between the teeth of the saw next to it. H′ is a comb, which consists of a number of saw-formed teeth fitted into and securely fixed in a bar of metal, which is secured to the frame A in such position that the teeth of the revolving rasp just pass between and within the teeth of the comb, which insures the complete rasping up of the substance operated upon. I is a circular brush, which occupies a position within the case G, immediately over the saw-toothed roller H. The brush is put in motion by a wheel K, affixed on the same spindle F as the saw-toothed roller, and which wheel gears into a pinion L on the spindle of the circular brush. By this arrangement of the wheel gearing, the circular brush revolves along with, and not against, the teeth of the roller, but at the same time revolves with greater velocity, and thereby is made to clear the roller from any substance that may happen to be adhering to the teeth or surface of it. M M are a pair of feed-wheels, which are each composed of a set of discs with tangential teeth formed on them, and combined together by being placed upon the spindles on which they are mounted.

These feed-wheels derive a comparatively slow motion from a pair of bevil-wheels N N, which give motion to a transverse shaft O, which has an endless screw P cut upon it which gears into the crown wheel Q, and worm-wheel R, the former of which is upon the upper feed-roller spindle, and the latter upon the lower one. The upper feed-roller has its bearings in sliding pieces *a a*, which move in slots in the general framework, and to these sliding-pieces there is attached a weight *b*, which is suspended from the bent levers *c c*, by which arrangement a uniform and constant pressure is exerted upon the feed, whether it be greater or smaller. SS′ are a pair of bruising rollers, which are placed immediately underneath the saw-toothed roller and are put in motion by the wheel T, which gears into the wheel D. The wheel T is affixed to the spindle of the roller S, and upon the opposite end of that spindle there is keyed a wheel U, which gears into a pinion V, keyed upon the axis of the roller S′. The rollers S S′ are, by having wheels with different numbers of teeth upon them impelled at different velocities, so that any substance which passes between the rollers is subjected to a drawing as well as a crushing action. The crushing pressure exerted by the rollers is produced, and may be regulated to any extent, by means of the weight W, which acting upon the longer end of the bent lever X presses the rollers together by the shorter end of the lever pressing against the bearings of the roller S′. The substance to be bruised, crushed, or mashed up into a pulp, for the purpose of expressing the juice, is put into the trough Y, and by means of the feed-rollers it is drawn into the machine, where it is first subjected to the action of the circular rasp, or saw-toothed roller, and next to the crushing and drawing operation from the rollers S S′, after which it may be collected in a trough placed underneath them, or may be gathered out from beneath the machine according to the nature of the substance operated upon.

And having now described the nature of my said invention, and the manner in which the same is to be performed, I declare that what I claim is as follows:

Fig. 4.

Fig. 3.



First. I claim the improved machine for the purpose of bruising, crushing, and expressing juice from vegetable substances, before described in the general arrangement and adaptation of parts of which the same consists, that is to say, in so far as regards the combining in one machine of the feed-rollers, the circular rasp, or saw-toothed roller, the toothed comb, the revolving brush, and the crushing-rollers, and whether these rollers be made to move with equal or unequal velocities.

Second. I claim the employment in machinery for bruising, crushing, and ex-

pressing juice from vegetable substances, of a brush revolving along with circular rasps, saws, or toothed rollers, and the actuating of the same respectively, in such manner that the periphery of the brush shall move with a greater velocity than the teeth of the rasp, saw, or roller, and so as to clear the teeth from substances adhering to them, as before described.

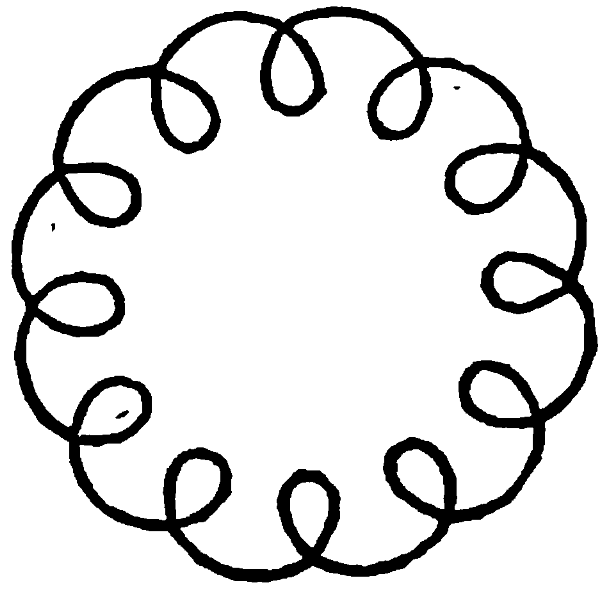
MR. LASSELL'S MACHINE FOR POLISHING SPECULA.

[We have had a great many applications at different times for a description of this machine, and are happy to be able now to lay before our readers a very complete one, which we borrow from the third volume, just published, of Mr. Holtzapffel's admirable work on "Mechanical Manipulation," to which it was supplied by Mr. James Nasmyth.—Ed. M. M.]

A very valuable machine for polishing specula has been contrived by Mr. W. Lassell, of Starfield, near Liverpool. The attention of this gentleman has been for many years devoted to the construction of reflecting telescopes, and his success in figuring by hand specula of all sizes, up to 9 inch diameter, and 9 feet focal length, led him to conceive the idea of constructing a telescope with a speculum of 2 feet diameter and 20 feet focal length.

As a preliminary step to the construction of the speculum, Mr. Lassell inspected Lord Rosse's laboratory, and the performance of the machinery for grinding and polishing specula appeared so satisfactory, that Mr. Lassell determined to employ a similar machine for polishing his 2 foot speculum. But finding after many months' trial, that he could not succeed in obtaining a satisfactory figure, he was led to contrive a machine for imitating as closely as possible those evolutions of the hand by which he had been accustomed "to produce perfect surfaces on smaller specula." The idea of the machine was communicated by Mr. Lassell to his friend, Mr. James Nasmyth, of Patricroft, near Manchester, by whom the mechanical details were designed, and the machine constructed on the beautiful arrangement shown in fig. 1135, which is copied from a drawing kindly supplied by Mr. Nasmyth, and we are also indebted to the same gentleman for the annexed description, which he has obligingly written for these pages:—

"The power is conveyed in the first instance by a band or belt to the pulley A, which conveys motion by the endless screw B to the wheel C. The spindle of the wheel C, viz., D, has made fast to it a crank or arm E, which carries a pinion F, and causes the pinion to revolve round the toothed circumference of the wheel G, which wheel G being fixed to the bracket H, causes the pinion F to revolve with as many turns as its circumference is less than that of the wheel G, viz., 5 to 1.



"As the spindle of the pinion F has a wheel K fixed to it at its lower end, this wheel K in like manner conveys motion to the pinion L, which works on an adjustable centre pin; and as the T groove in which the centre pin of L works is radial to the centre of the wheel K, this pinion may be set to any degree of eccentricity and yet be in gear with K.

"It will also be seen that the pinion L has a cross-crank M attached to its under side, which having its crank-pin N also sliding in a T groove, it may be set to and fixed at any degree of eccentricity, so that we have by these two eccentric movements the means of giving to the pin N any compound motion we require.

"The polisher is of wood, or other suitable material, coated with pitch, and divided into squares. This polisher is free

to move upon the pin N, while N causes the polisher to slide over the surface of the speculum with a motion somewhat like that shown in fig. 1136.

"In order to cause every part of the surface of the speculum to continually change its situation with respect to the movements of the polisher, it has also a

slow revolving motion given by an endless screw P, pitched or working into the teeth of the wheel R, which forms the base on which the speculum rests while receiving the action of the polisher.

"The speculum rests on nine equilibrium points, so that each ninth of its body is made to rest on a point or surface placed under the centre of gravity of each ninth of the speculum surface, and so avoid all risk of distortion. It is the best practice to polish the speculum while resting in the cell in which it is to be when actually in the telescope, so as no risk of distortion may occur, as would be the case were it removed, after polishing, into another cell or bed.

"By means of this admirable machine, a speculum having a decidedly hyperbolic figure, may be corrected and brought to a perfect parabola, or to a spherical curve; or the same may be done in the reverse order at pleasure. A stronger proof of the perfect capabilities of Mr. Lassell's machine could not be given."

From the foregoing description, it will be seen that the essential difference between the machines contrived by Lord Rosse and Mr. Lassell is, that in the former the polisher is traversed over the speculum with reciprocating longitudinal motion, and in the latter the polisher has a continuous epitrochoidal motion, the path of which is dependant upon the adjustments of L and M. Mr. Lassell's polisher was made of two thicknesses of pine-wood, with the grain crossed; this, from its lightness, did not require to be counterpoised, and—apparently from its being sufficiently yielding to accommodate itself somewhat to the form of the speculum—a single coating of pitch was found sufficient, and the polishing was completed with wet powder.

Very complete evidence of the perfection of the speculum polished in this machine is afforded by the circumstance that, with the telescope to which it was fitted, Mr. Lassell discovered the satellite of Neptune—the eighth satellite of Saturn, and re-observed the satellites of Uranus; which latter, since their announcement by Sir W. Herschel, had been seen by no other observer. These results have already arisen from the employment of Mr. Lassell's admirable contrivance and dexterity in the management of his polishing machine, and his excellent skill as an observer, in conjunction with a very perfect and powerful instrument which has resulted principally from his own skilful exertions. The high value attached to these contributions to science is evidenced by the circumstance that the Royal Astronomical Society awarded their gold medal for 1848 to Mr. Lassell.

Since the Earl of Rosse has shown that, contrary to the previous general opinion, specula may be successfully polished by mechanical means, other machines have been constructed for the same purpose, but have not been applied to specula of such large dimensions. In Dr. R. Greene's machine for grinding and polishing specula and lenses, rewarded by the Society of Arts in 1834 (*see* Trans., vol. l., p. 140), the polisher is mounted on a very slowly-revolving axis, and the speculum also revolving slowly, but at a different rate, is traversed over the polisher by means of a central pin joined to the extremities of two horizontal connecting rods at right angles to each other, actuated by two cranks—the relative velocities, length of strokes and angular positions of which all admit of adjustment; and consequently the mirror can be traversed over the polisher in an infinite variety of curves.

MR. THOMSON'S PATENT WATER-WHEELS.

(SEE ANTE, PP. 42 AND 62.)

The following letters on the subject of these wheels have been received from Dr. Schinz and Professor William Thomson:—

From Dr. Schinz.

"When I attended the meeting of the British Association in Oxford, I communicated to the Mechanical Section some observations on the importance and frequent application of horizontal water-wheels, so called turbines, in Switzerland.

"I pointed out the great advantage they possess in their principle, in being applicable for any height of waterfall, and in requiring no heavy gearing for bringing up the speed to what is commonly required, on account of the great rapidity of revolution at which they work to the greatest advantage.

"I had also the honour to call the

attention of the Mechanical Section to two kinds of turbines brought into operation a few years ago in Alsace and Switzerland.

"One is remarkable for the principle of a suction pipe, by which the pressure of the air is taken away fully or partly from the back of the vanes of the wheel, so that the velocity with which the water rushes through the directing or fixed vanes upon the wheel placed beneath, is determined by the sum of the column of water above, as well as beneath, the wheel. This disposition gives the advantage of enabling the engineer to place his wheel at any convenient distance, less than 32 feet, from the lower water-level.

"The other involves the principle of injecting the water from the outer circumference of a horizontal wheel in a tangential direction, so as to cause the water to rush towards the centre of the wheel in losing all its tangential motion, by pushing the curved vanes of the wheel forward. Whilst, in the turbine of Fourneyron, the water being injected at the interior, leaves the wheel with a very considerable velocity in relation to the wheel, and causes, therefore, a considerable friction; this wheel, with outside injection, is left by the water having, as it were, no horizontal motion at all, and therefore no appreciable friction from this reason.

"Both of the above-mentioned principles have been carried out in great variety of height and power, giving, in almost every instance, very satisfactory results.

"I am now happy to say, that a very careful inspection has convinced me of the merits of the suction-wheel of Mr. James Thomson, of Glasgow College. It combines in a most favourable way the two above-mentioned principles of suction and exterior injection, though it is altogether different from the wheels in which those principles have been employed.

"The utmost velocity attained by the water in this turbine, is that due to half the height of the disposable waterfall; and from this cause the friction is much less than in other turbines, in which the water usually attains, at two successive times, the velocity due to the whole fall. Once being in the wheel, the water will meet in no way with any appreciable kind of friction or collision, as it runs gently through the vanes and suction-pipe without any admixture of air, the force of suction being balanced by the centrifugal force. This gives the wheel, so far as I am aware, a superiority above all the existing water-wheels. The regulation of the required supply of water is easily carried out, and is made self-acting by ingenious but simple mechanism.

"I am able to state, that I took part in several experiments made upon a model of the above-mentioned suction-wheel of Mr. Thomson, calculated to work at about one-tenth of a horse power.

"Great care was taken in measuring exactly the height of the waterfall really employed, as well as in measuring the supply of water used.

"I calculated that the uncertainty of the result, arising from the faults in estimating the mechanical action of the water itself, could not amount to more than one per cent.

"As a dynamometer, a well-constructed *frein dynamométrique* of Prony was applied, whose indications were to be considered sufficiently exact, as it appeared very steady in the course of the observations, each of which lasted for something more than ten minutes.

"Two of the observations gave the following data:—

	First Experiment.	Second Experiment.
Height of the head	4 feet 3·75 in.	4 feet 3 375 in.
Quantity of water	1,000 im. gals.	1,100 im. gals.
Number of revolutions	1,155.	1,140.
Weight depending from the end of the lever of the dynamometer	5 5 lbs.	5·5 lbs.
Circumference (this lever being radius)	6 feet	6 feet.

"My calculation gives:—

	First Experiment.	Second Experiment.
Mechanical action of the water	47,437 ft. lbs.	47,094 ft. lbs.
Mechanical action of the wheel	38,115 ft. lbs.	37,620 ft. lbs.
Therefore, the number of per cents. rendered useful by the wheel	80·35.	79·89.

"The mean of both gives 8·1 per cent. of mechanical action obtained from this model, which, being made of tin-plate, had some imperfections in its construction that injured its action. This is certainly a result of the most satisfactory

description, and which may be easily surpassed by a more careful execution of the elaborate details laid down by the inventor.

"There is another invention of Mr. Thomson he calls a case-wheel, different in form, but nearly according to the same principles. It is also very easily regulated, and contains, besides, in its own principle, a certain kind of regulating power; the increased centrifugal force of the wheel being able to check the supply of water to a certain extent, when it has less work to do. This is a property which may prove valuable, as it enables the regulator to be dispensed with, which is in most wheels very expensive, where some latitude in velocity is granted, and when the supply of water is abundant.

"EMIL SCHINZ,

"Professor of Natural Philosophy and Mechanical Arts in the College of Aargau, in Switzerland.

"*Edenbarnet, Sept.* 12, 1847."

From Professor William Thomson.

"I have examined with care the principles and construction of the new horizontal water-wheels, invented by my brother, Mr. James Thomson; and it seems to me that, in these machines, the best possible means are taken for obtaining mechanical effect from a given fall of water.

"In any water-wheel whatever, only a per centage of the work due to the entire fall can be obtained; but if the water be introduced into the wheel without shock, be allowed to pass through it in a continuous mass, with no violent rushing, and be discharged with a very small velocity through a sufficiently large channel or pipe, the adaptations being in other respects good, the loss will be as slight as possible. The principles adopted by my brother in his wheels are in entire accordance with these conditions, so that the various sources of loss, which in other water-wheels arise from the violation of some of these conditions, are in the new wheels almost entirely avoided.

"Besides the general fulfilment of the above-mentioned essential conditions for a good machine, there is, in the new water-wheels, a very remarkable adaptation; according to which, by the balancing of the contrary fluid pressures due to half the head of water, and to the centrifugal force in the wheel, only one-half (instead of the whole, or more than the whole, as in most of the turbines already known to the public) of the work due to the fall is spent in communicating *vis-viva* to the water, to be afterwards taken from it during its passage through the wheel; the remainder of the work being communicated through the fluid pressure to the wheel, without any intermediate generation of *vis-viva*. By this important arrangement, the velocity of the water where it moves fastest in the machine is very much reduced; and the loss due to the retarding action of channels or passages, which cannot be entirely removed in any hydraulic machine, is thus diminished to a remarkable degree. In this valuable characteristic, the new water-wheels have a great superiority over the best turbines of Fourneyron or Poncelet.

"I have seen experiments made with models of the various modifications of the new wheels. These models worked in an extremely satisfactory manner, and gave a very high per centage of the total work due to the water. In making trials of water-wheels, experimenters have frequently obtained results indicating very high per centages of work, in which they have been deceived from various causes of uncertainty or error; especially by the methods they have adopted for measuring or estimating the quantity of water used. In the present case, however, I consider that entire confidence may be placed in the experimental results.

"I have no hesitation in expressing it as my opinion, after most mature consideration, that, both in convenience and in efficiency, the new water-wheels are superior to all other horizontal water-wheels which have been brought before the public.

"WILLIAM THOMSON,

"Professor of Natural Philosophy in the University of Glasgow.

"*Glasgow, March*, 1848."

PAINE'S LIGHT.—EXPERIMENTAL INVESTIGATION OF THE EFFECT OF PASSING HYDROGEN GAS THROUGH TURPENTINE.

Sir,—I am much astonished to see, as I do in your 1434th Number, such an extraordinary matter made of a simple

experiment. Many surmises and hypotheses are propounded which are dependent upon an assumed fact,—that turpentine loses nothing in weight when hydrogen has been passed through it, yet that the so transmitted hydrogen gives a greatly increased light. Now I must place myself in the same position as the philosopher did when King Charles proposed his question about the fish in a pail of water—I must deny the fact.

Hydrogen passed through spirit of turpentine *does* dissolve a portion; and to this turpentine the light is entirely owing. In my laboratory an accurate experiment has been made, in which 5½ ozs. of zinc were dissolved, and 2·38 cubic feet of hydrogen disengaged; these were passed through spirit of turpentine—as the temperature increased, the hydrogen flame became bright, and at the close it was found that 83 grains of the fluid had been absorbed. I presume, therefore, that Mr. Paine, when exposing his process, could not have resorted to the balance as a test of the truth of what he advanced. I hope there is better ground for the claim of wonderful improvement in the decomposition of water, otherwise Mr. Paine will be a long time before he pays the expenses of his patent out of profits.—H.

[The preceding communication is from an English chemist of the first celebrity as an experimental investigator.—Ed. M. M.]

WATER GAS.—SHEPARD'S PATENT.

(*From the "Freeman's Journal."*)

Our readers are familiar with the fact that an American (Paine) had succeeded in decomposing water, and so combining its hydrogen with carbon as to form an illuminating gas, which he proposed as a substitute for the gas produced by the destructive distillation of coal in iron retorts. The invention at first attracted a great deal of attention; but so far as we have been able to learn, the process by which the gas was produced was both *costly* and *uncertain*. Since the period at which the American discovery was announced, a German chemist of great eminence has announced the discovery of a process by which the water may be decomposed, and the carburetted hydrogen formed at little more than a nominal cost, with unerring certainty, and in, practically, an unlimited quantity. The gas so produced is said to possess illuminating power far exceeding that of ordinary coal gas, and is capable of producing, in the act of combustion, such an amount of caloric as to constitute an economic substitute for coal in the generation of water steam for the propulsion of boats and locomotives.

This invention has been patented in most of the countries of the European continent—in England, in Scotland, and in Ireland, by Mr. Shepard, an English gentleman, whose intimate connection with the continental states afforded him peculiar facilities for the great enterprise in which he has embarked. We understand that the gas produced by Mr. Shepard's patent is not only capable of being used as a fuel for the generation of steam, but is itself capable of being adapted to all the uses to which steam power is now applied—the expansive gas itself performing the functions of high-pressure steam. Several great English Companies have already entered into contracts for the use of this patent, which if it should realise the expectations of the patentee is destined to create a revolution little inferior to that created by the application of steam as a locomotive power. The great value of the patent is said to be the low cost at which the gas can be produced.

The *Times* thus alludes to this strange and most interesting invention:—

"Steam and Gas without Coal.—It is scarcely thirty years since a Committee of the House of Commons doubted the possibility of travelling at the rate of even fifteen miles an hour. Winsor, too, was laughed at when he proposed to light street lamps with coal gas; Dr. Lardner endeavoured to prove the impossibility of a steamship ever crossing to America; Professor Wheatstone was treated as a clever enthusiast when he first promulgated his ideas of the electric telegraph; yet all these things have been brought into successful operation. One or two of the principal railway companies have lately entered into an arrangement with Mr. Shepard, who has patented an invention for the decomposition of water, and negociations are pending with some steam-boat and gas-companies for the application of this patent to propel steam-boats, locomotives, and other engines, by which the cost of working machinery and generating gas is likely to be greatly reduced. At the coming Exhibition we hope to have an opportunity of testing the merits of this wonderful invention."

THE HELICOGRAPH.

Sir,—In the paper which you were good enough to insert in your Journal, respecting the new spiral instrument called the Helicograph, there is an error in the mathematical formula which ex-

presses the ratio of the diameter of the wheel to the form of the spiral. This formula, as printed, page 91, is

$$a^{2\pi} = \epsilon \frac{2\pi x^2 - 2}{\pi^2 x^2 + 3}.$$

whereas it should be

$$a^{2\pi} = \epsilon^{\frac{2\pi x^2 - 2}{\pi^2 x^2 + 3x}}$$

I am Sir, yours, &c.,
F. C. PENROSE.

4, Trafalgar-square,
Feb. 11, 1851.

P.S. The instrument will be to be seen in a few days at Messrs. Elliott and Sons, 56, Strand.

MODE OF LIGHTING LAMPS OF GREAT HEIGHT.

Dear Sir,—I beg to introduce to your notice a plan for lighting public or other lamps, which by reason of great height or other circumstances are difficult to light by the ordinary method.

This plan is the invention of Mr. John Ayliffe, engineer, and Superintendent of the New Gas-Lighting Company, St. Petersburgh, and has been adopted with great success on the Nevski Iron Bridge, over the river Neva, where the lamp columns are 22 feet in height, and on account of this, together with the frost and wind, are highly dangerous to light by means of ladders, but which are now lighted with ease and safety by this method.

If you will have the kindness to insert this in your valuable work, it may be made available in similar cases where other contrivances might fail.

I am, Sir, yours, &c.,
W. T. SUGG.

19, Marsham-street, Westminster,
February 3, 1851.

Description.

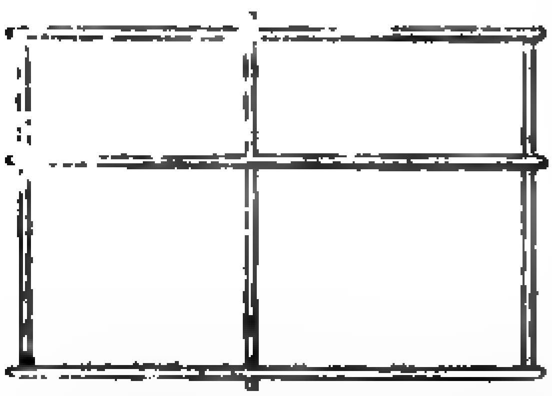
No. 1 is a lamp-post, with lantern, gas-burners, and apparatus. No. 2 is a brass cock attached to the service pipe for lighting up the burners. No. 3 a small tube, with a burner attached to it and joined to the service-pipe under the cock, which can be moved up or down by opening or shutting the cock. No. 4 is a packing laid for the tube, No. 3, to work in. No. 5 is a wrought iron rod for lifting tube, No. 3, to a sufficient height, so as to ignite any quantity of gas that may pass out of the burners *a*.

SAFETY BOOK-CASE.

Sir,—I wish to lay before your readers a simple plan for securing the volumes in a book case without hinged doors or other expensive or inconvenient additions to it.

Fig. 1.

Fig. 2.



Let fig. 1 represent a set of book-shelves, with three rows of books, and fig. 2 a slight framework of wood or brass, composed of horizontal bars placed at distances apart exactly corresponding with those of the shelves. Now if this frame be adjusted to the book-case, and the *vertical* bars AA run in grooves on BB, the *frame* may be made to cover the edge of the shelves so as not to be noticed, and offering no hindrance to the extraction of any volume. But if it be desired to confine the books to the shelves, slide the framework a few inches up until it assume the position of the dotted lines in fig. 1, and secure it there by a lock (in the centre v rtical, for instance.) The books will now be safely kept against all depredations unaccompanied by positive violence.

The advantages of this plan seem to be its simplicity, its constant readiness for immediate use, and the fact that it rather ornaments than disfigures the book-case when left open. I am, Sir, yours, &c.,

JOHN MACGREGOR.

24, Lincoln's-inn Fields, *Feb.* 1, 1851.

JUDICIAL COMMITTEE OF THE PRIVY COUNCIL.

PRESENT.—LORD LANGDALE, THE RIGHT HON. T. PEMBERTON LEIGH, THE RIGHT HON. DR. LUSHINGTON, AND THE RIGHT HON. SIR EDWARD RYAN.

Electric Telegraph Company—Extension of Patent.

The Electric Telegraph Company sought to obtain the prolongation of letters patent which had been granted to William Fothergill Cooke and Charles Wheatstone on the 12th of June, 1837. The books of the petitioners were made up, it appeared, and balanced to the 31st December last, and the subjoined statement will show the receipts and disbursements of the petitioners since the introduction of the electric telegraph:—

Receipts from the railway companies for their use of the company's patents............	£122,285 13 2	
Receipts from maintenance and sundries.....	7,301 13 1	
		£129,587 6 3
In addition to the foregoing, the company have received gross profits on the erection of telegraphs for railway companies amounting to		40,747 4 2
		£170,334 10 5
Less charges, including part of the law and parliamentary expenses		34,319 6 7
Making the total receipts		£136,015 3 10
Total amount paid for patents		£167,[illegible] [illegible] [illegible]
Showing that, after crediting the patent account with the abovementioned amount of £40,747 4s. 2d. received for erections, the total payments have exceeded the total receipts by.....................		31,673 4 2
The Company have in their books charged the capital account of their commercial telegraph with £33,808 10s. 8d. as the estimated value of the patent employed therein. If this nominal charge be added to the amount of actual receipts, as above stated, the patent account will then show an apparent surplus for all patents of		1,[illegible] 5 6
The commercial telegraphs have yielded during the three years which have elapsed since the commencement of their working a total gross return of ...	£103,444 7 11	
At charges amounting to	83,265 6 11	
Showing a surplus of		20,179 1 0

Which surplus of 20,179*l.* 1s. is the total nett return upon a capital of 104,229*l.* 17s. 3d.

—the actual cost, but much more than the present value of the plant—the amount actually expended in the erection of the commercial telegraphs; or upon a capital of 137,833*l.* 8s. 4d. if the patent account is to have the benefit of the above nominal charge of 33,603*l.* 10s. 8d.

The evidence which was adduced in support of the petitioners' case was chiefly directed to show the reasonable charges made by the Company, and the accuracy of the accounts.

Their Lordships decided that, as the Patentees themselves had been sufficiently rewarded, the Company—who derived their right from them—had no *locus standi*, and therefore refused the application.

ADVENT OF THE ARTS.

Man has everywhere made his debût in the character of an Orson. Soon as the curtain rises, behind which there is no peeping, as an untamed animal he leaps upon the stage, and as such goes through the opening act. The annals of all the people of old began with their condition as savages. Those of the Jews form no exception; their earliest progenitors are represented as being at the foot of civilization's ladder both in arts and morals. Of the present occupants of the earth, the records of the enlightened trace their forefathers to various phases of this same low condition, beyond which a large portion of mankind has not yet advanced—an indication of the infancy of the species.

Man's physical wants first o c pied his attention. In the dawn of his being he was as ignorant of others as his wildest descendants are now. In common with creatures below him, his necessities were his monitors, designed by his Maker to initiate into habits and awaken impulses that were to become distinguishing traits of his race. He was to be a thinker and worker. All creatures act more or less from reflection; but in him these qualities were to be preeminent. He was to live by his ingenuity and labour, according to a law from which no order of beings on our globe is exempt, and most likely on no other.

It is irrational to suppose that happiness of any kind can be realized except as the reward of efforts to attain it. In this respect ants and angels are probably alike. Every living thing is furnished with organs adapted to its nature and the theatre of its existence; and on the proper application of these, its enjoyments and their augmentations are made to depend. Knowledge comes not to us by intuition, and the tenderest insect as well as the mightiest quadruped perishes that uses not the means given it to live. All are ordained to preserve life by the diligent employment of their faculties, and all are urged thereto by the most pressing of natural requirements. The spirit of the injunction, that man should earn his bread by the sweat of his brow was therefore nothing new, since it had been imposed as a condition of life, and of the enjoyment of life from the beginning. Indeed, it is not conceivable how any of earth's denizens could have been disciplined for the work assigned them had not their energies been stimulated into action by privations. Man certainly could not, as the story of Eden proclaims; philosophy and experience unite in declaring that had he been encircled with perpetual ease and abundance, the sloth and the glutton, with a mind torpid as in zoöphytes, had become united in him, His sin was indolence, and, in a natural point of view, that includes all others;—it is one for which there is no forgiveness—can be none. He preferred, and so have his unreclaimed and half-reclaimed descendants to this day, to live on spontaneous food rather than earn it by labour, as commanded, —hence it was a blessing to expel him—a curse to let him stay. Had he been permitted in loose idleness to live,

> "With brother brutes the human brute had grazed."

No one doubts that, at his advent, ample provision was made for him, else he had perished in his nonage; and that it was continued till, by increasing numbers, the species was established. He was then urged to retire from a location merely intended as the cradle of his infancy,—a nursery in which he was to grow till strong enough to provide for himself. His very nature and organization made labour necessary to both mental and bodily vigour; but in the midst of plenty he had no motives to activity nor useful pursuits. Even now, with all our experience of the value of science and art, were the earth to bring forth without culture food in superabundance, and continue to produce it, mankind would inevitably fall back into barbarism.

As with man, so with all terrestrial creatures. None came till the earth was ready to receive them. Every genus had its Eden, in which its first representatives burst into being, and were nourished till strong and numerous enough to migrate. They, too, were then driven out.

If, therefore, wants had never been felt, the arts had never been known; and without them there could have been neither science,

refinement, nor morals. Happily, then—thrice happily—did sterility of soils, inclemencies of seasons, scarcity of game and other food, force man to reflect, invent, and construct—to become an artificer—and thereby to clear the way for the unfolding of the higher qualities of his being.

In the arts of modern animals we find those of their earliest representatives, and in the handicrafts of living barbarians we may contemplate those current in Eden and in the colonies that sprung up around it, for there is as marked a resemblance in the primal devices of man as in those of the groups below him; and necessarily so, since originating in the same wants, the same instinctive impulses suggested, and will ever suggest, them. While pressing emergencies give rise to primal devices, necessities led to their improvements and multiplication. Whenever a marked advance took place, it seems to have arisen in much the same way as among inferior beings. If we examine the habits and actions of these, we shall find the same diversity of temper, talents, and their consequences, prevailing as with us. The ingenious and industrious thrive, the idle and inexpert suffer. Every creature, from the lion to the lion-ant, the eagle to the ephemeron, is the author of its own fortunes, good or bad. Some in advance of their fellows, modify staple structures and stratagems to meet unusual emergencies, and are rewarded for their pains. They are the inventors of their tribes. Novel circumstances suggest new ideas, which become manifest in new forms, materials, and practices. Precisely so with the animal—man: as circumstances changed around him so did his devices; and hence useful results gradually accumulated, and the avenues to civilization opened.

If necessaries were the parents of invention, conveniences were its nurses, and enjoyments its teachers. As society improved, so did these; and, keeping in advance, they courted and encouraged it on. Suggesting new ideas, they kept enlarging human prospects, and eliciting new desires which required higher efforts to fulfil. In this way the most refined of people have risen from the rudest,—and in this way people must always rise; every decided acquisition in the beginning leads to another, and it to others, and others,—so that the truth is now becoming apparent, that accessions to science and art can only cease with human progress; and the converse—when it is arrested they must decline, and as it retrogrades they will disappear one by one till the race revert to primitive ignorance and infelicity.—*Report for* 1850 *of Wm. Ewbank, Esq., American Commissioner of Patents.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING FEBRUARY 13, 1851.

THOMAS DICKASON ROTCH, Esq., of Drumlamford-house, Ayr. *For an improved mode of manufacturing soap.* (A communication.) Patent dated July 31, 1850.

The nature of this invention consists in the introduction of certain sulphites, bisulphites, and polysulphites into the fatty, resinous, and other compounds undergoing the process of saponification in the manufacture of soap.

When during the saponification bisulphites of soda are to be introduced into the mass, the ordinary soap pan is to be used, and the process conducted in all respects in the usual manner by filling in the caustic lyes and fatty or other matter, in proper proportions, to be converted into soap, and by heating the mass to the proper degree of temperature. When arrived at this point, Mr. Rotch adds twenty parts of bisulphite of soda, dissolved in water, to every 1000 parts of fatty or other matter to be saponified. The process is then continued in the usual way for making soap, without any alteration in consequence of the addition of the sulphite of soda. When potash is to be introduced instead of soda, the proportions differ; he then adds 25 parts of bisulphite of potash, dissolved in water, to every 1000 parts of fatty or other matter to be saponified; the operation being otherwise conducted in the usual manner when potashes are used. When lime is to be introduced into the saponifying mass, he adds 20 parts of bisulphite of lime to each 1000 parts of fatty or other matters to be saponified—the bisulphite of lime being carefully diluted with water into a kind of milk of lime before it is poured into the mass in the pan; the rest of the operation being conducted in the usual manner.

The patentee proceeds to describe another mode of carrying his invention into effect, which, under some circumstances, is cheaper, and may be preferable to those before described. During the whole of the ordinary process of saponification, he causes a current of sulphurous acid to be continuously passing through the mass of boiling fatty or other matter, in the proportion of $6\frac{442}{1000}$ parts of sulphurous acid to 1000 parts of fatty or other matter, and he accomplishes this by the decomposition of sulphuric acid in an apparatus of peculiar construction, which is particularly described. About 2 lbs. of charcoal being introduced into this apparatus, with about 20 lbs. of sulphuric acid, at 66° of Baumè, heat is applied till the decomposition of the sulphuric acid is

effected, the fire being kept up during the whole process of saponification.

Claim. — The introduction of suitable sulphites, bisulphites, and polysulphites into the saponifying masses of fatty or other matter, as before described.

John Gwynne, of Lansdowne Lodge, Notting Hill. *For improvements in obtaining motive power, and in applying the same to giving motion to machinery.* Patent dated August 5, 1851.

The present improvements have reference to the turbine or re-acting water wheel, adapted to a constant or graduating head of water, and particularly applicable in tide ways or tidal rivers. The construction of the bucket, and a method of regulating and equalizing the working of the machinery by cone pulleys, the strap of which is moved to the right or left by the action of a float, which rises and falls with the water, are the principal novelties.

Claim.—Obtaining and applying motive power by means of a wheel, the buckets of which are formed of two curvilinear portions, connected by a rectilinear portion, arranged round a circle, and enclosed within an annular casing.

Alexander Melville, of 50, Baker-street, Portman-square, gentleman, and Edward Callow, of Park-road, Stockwell, gentleman. *For certain improvements in muskets, cannons, and other fire-arms, and in explosive compositions and instruments.* Patent dated August 6, 1850.

Claims. — 1. Several improvements in construction of cannons, muskets, and other fire-arms, in which the charge is introduced at the breech; and also a new gun-lock.

2. A method of mounting cannon, whether used at sea or on land. The object of this is to facilitate the pointing and working of the gun.

3. Three combinations of materials forming explosive compositions. *First Compound.*—Two parts (by weight) of chlorate or oxymuriate of potash, and one part orpiment or red sulphuret of arsenic. *Second Compound.*—Five parts of chlorate of potash, one part of prussiate, or ferro-cyanate of potash, and two parts orpiment. *Third Compound.*—One part chlorate of potash, and one part prussiate of potash. These ingredients are to be separately comminuted by grinding in mills, under edge runners, or otherwise. They are then passed through hair sieves of the required fineness, after which they are mixed in sieves. As the compounds are of a detonating character, care must be taken to avoid concussion as much as possible while mixing. The several compounds are damped and made into cartridges for guns, and for blasting and mining purposes.

4. Attaching wings to shells. The wings fold into recesses formed in the shell, but expand as soon as the shell is fired. A cap is placed on the nozzle of the shell, to cause it to explode on coming in contact with any object.

5. Fixing a belt of soft metal round cannon shot. These shot are fired from rifled cannon.

6. An explosive arrow to be fired from a bow, and tipped with a percussion cap, in the same manner as the shell above mentioned.

Joseph Steele, of Chancery-lane. *For improvements in coating and impregnating metals and metallic articles.* (A communication.) Patent dated August 9, 1850.

Claims. — 1. The coating and impregnating metals and metallic articles with a solution composed of the different ingredients mentioned (whose proportions may, however, be slightly varied), and worked in conjunction with a current of electricity, so as to give to such metals or metallic articles the appearance of tin.

The bath alluded to is composed as follows:—75 gallons of distilled water are placed in a non-metallic trough, and heated by steam to about 15° Fahr. above the common temperature; 60 lbs. of common soda are dissolved in a separate vessel with some of the hot distilled water, and strained through a hair sieve into the trough; 15 lbs. of Russian or American potash are next dissolved in some of the warm solution, and strained through a sieve into the trough, after which there is added 5 lbs. of caustic potash, also previously dissolved in some of the warm liquor of the bath. Two ounces of cyanide of potassium, two ounces of acetate of zinc (dissolved separately in some of the warm solution), and 16 lbs. of bioxide of tin, complete the bath, which will be ready for use when it has stood for two or three hours. If a crust or dirt should rise, more alkali must be added, and if the bath should assume a reddish tinge, sulphate of zinc. The articles to be coated are immersed in the bath at a heat of 25° above the ordinary temperature, care being taken that they are previously well cleansed. One pole of an electric battery is to be in connection with the article, and the other with an electrode of pure tin or zinc suspended in the solution. The former is preferred, as it gives a whiter deposit.

2. The coating of metals and metallic articles with a solution of brass and copper in conjunction with a current of electricity, and the giving to their surfaces, when coated with either of these solutions, a tint of bronze, as described.

This bath is composed of 6 gallons of distilled water, heated as before; 2½ lbs. of American potash, dissolved separately in some of the water, and passed through a sieve into the bath; 2½ ozs. of powdered acetate of copper, mixed separately with half a pint of strong spirits of ammonia, 4 to 5 ozs. of sulphate of zinc, and 2 ozs. of cyanide of potassium. This bath is ready for immediate use, but it is preferred to allow it to remain quiescent for three or four days. The sulphate of zinc is omitted from the copper bath. The articles to be immersed must be previously well cleansed from grease and dirt. The battery which the patentee prefers, is that known in Belgium and France as the "Maheux battery." A brown bronze for articles coated with either the brass or copper solution, is composed of three-fourths of a pint of water, the same quantity of sulphuretted ammonia, 2 ozs. of red colouring matter, with French chalk and black lead, according to the colour required, mixed up like paint, and applied with a brush. For green bronze, like quantities of water, sulphuretted ammonia, and Prussian blue and chrome yellow at the discretion of the operator.

3. The coating of metals and metallic articles with gold, in conjunction with a small electrode of zinc or copper, to give to such metals and metallic articles the appearance of gold.

This process is conducted as follows:— 1 oz. of gold is dissolved in 3 ozs. of nitric acid and 4 ozs. of hydrochloric acid over a spirit lamp, and heat is applied until the acids have evaporated. 24 ozs. of prussiate of potash and 12 ozs. of carbonate of potash are placed by degrees in a red-hot crucible, and, when melted, poured into an open earthenware dish. The vitrified potashes are then boiled for about five minutes, with two to three gallons of water, in an enamelled iron pot. This mixture is next filtered, and the filtered water used to wash out all the dissolved gold from the vessel in which it was placed; the whole is then boiled for about fifteen minutes, and again filtered. The articles to be coated are immersed in this liquor at 20° to 25° Fahr. above the ordinary temperature, in contact with an electrode of zinc or copper, by which the deposition is effected. If a darker colour than that of pure gold be required, it may be obtained by dissolving with the gold a few pennyweights of copper.

4. The coating of metals and metallic articles with silver, in conjunction with a small electrode of zinc, for giving to such metals or metallic articles the appearance of silver.

In carrying this part of the invention into effect, it is preferred to dissolve over a spirit lamp 4 ozs. of silver in 20 ozs of nitric acid. 1½ lbs. of muriate of *sodium* (query? soda)— common salt, is dissolved in a gallon and a half of water, and added to the silver solution. When the silver is precipitated, the liquor must be poured off, and the precipitate washed till free from the salt and acid. A solution of prussiate and carbonate of potash, as in the preceding case, is then prepared, and the silver precipitate boiled in it for about fifteen minutes. After filtration, the articles to be coated are immersed in this bath, in contact with an electrode or strip of zinc, and deposition ensues as in the preceding instance.

Selim Richard St. Clair Massiah, of Alderman's-walk, New Broad-street. *For improvements in the manufacture of artificial marble and stone, and in treating marble and stone.* Patent dated August 10, 1850.

Mr. Massiah first takes gypsum, sulphate of lime, or alabaster, cuts it of the desired shape, and submits it to a heat of from 80° to 150° Fahr. until perfectly dry. Secondly. The article is immersed in a warm solution of one pound of borax and a quarter of an ounce of sal-enixum to the gallon of water, and then taken out and dried. Thirdly. It is heated to 230° Fahr. and upwards, untl the watery particles are entirely driven off; after which it is allowed to cool until the hand can be borne on it for a second or two, and again immersed in a hot saturated solution of borax with concentrated nitric acid, in the proportion of a quarter of an ounce to an ounce to each gallon of solution. It is necessary that great attention should be given to obtaining the best and most highly concentrated nitric acid, as upon this depends, in a great measure, the quality and hardness of the marble. The article should be allowed to remain in this solution until completely saturated, when it should be taken out and allowed to dry. Fourthly. At the expiration of a day or two the article is to be gently heated, and to have Canada balsam diluted with turpentine or naphtha, applied to its surface. It should then be heated, or exposed to the air, to evaporate the spirit.

The above method of procedure is to be followed when plain marbles are required. If it is desired to produce a coloured marble, a suitable colouring matter must be introduced into the solution of borax with either nitric acid or a nitrate, *e.g.*, indigo and nitrate of iron, to produce a blue. Compound colours are produced by multiplying the processes; thus, after a blue colour has been obtained as above, the marble may be heated, allowed to cool slightly to prevent

decrepitation, and immersed in a solution of borax, nitric acid, and safflower, or any other red dye. The two colours will separate, and present in some parts the appearance of distinct unblended streaks or veins, and in others will be of a purplish tinge.

Other salts, such as alum, may be used in place of sal-enixum, to the use of which Mr. Massiah does not therefore confine himself. He claims the employment of nitric acid in the white and naturally veined marbles, and the mode of obtaining the compound colours, which may be tripled and quadrupled by multiplying the proce. Also the same process when applied to old, inferior, or decrepitating marbles, whereby they are effectually strengthened and dyed.

Francis Kane, of Berner's-mews, chair-maker. *For improvements in reclining chairs, in castors for chairs, and other articles of furniture; and improvements in presses.* Patent dated August 5, 1850.

Mr. Kane's improvements in reclining chairs have reference principally to the joints for connecting the parts, and to arrangements for retaining the back and leg-rest in any desired position.

His improvements in castors consist in connecting the horn with the socket by means of a spring catch, which allows freedom of play, but effectually retains the parts, although, if desired, they may, by releasing the spring, be at once disconnected.

The "improvements in presses" consist in so arranging inclined bosses on the axle of the fly-wheel of what are called "fly presses," that the sliding punch may be caused to rise and fall alternately by the continuous rotation of the wheel.

Claims as above.

Charles Cadby, of Liquorpond-street, pianoforte-maker. *For improvements in stringed musical instruments.* Patent dated August 12, 1850.

These improvements are exemplified as applied to pianofortes of different descriptions. The sound-board has been hitherto firmly attached to the framework of the instrument by glueing, and the tone, in consequence, instead of being clear and brilliant, is of a "woodeny tubby" character. Mr. Cadby now proposes to attach the sound-board to the framing by metal clamps, which are in some cases provided with screws, by which they may be tightened, so as to give a considerable degree of tension to the sound-board. In the cheaper descriptions of instruments these clamps are attached to one end only, the sides being left free, and the opposite end glued to the frame as usual. In order to counteract the strain of the tightened sound-board, on the framing horizontal tie-rods are placed at the back of the frame.

The specification also contains a description of several methods of relieving the sound-board of the downward pressure of the strings.

Claims 1. Suspending the sounding-board of pianofortes or other stringed instruments, by means of screw clamps or other contrivances, by which a considerable tension may be given to the sound-board, and the brilliancy of tone of the instrument proportionately increased. Also, the use of the tie-rods at the back of the frame, to prevent strain on the framing of the instrument, by the tension of the sound-board.

2. The methods described of relieving the sound-boards of pianofortes and other stringed instruments from the downward pressure of the strings.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, engineer. *For certain improvements in apparatus, acting by centrifugal force, in the manufacture of sugar, and other improvements in the treatment of saccharine matter by such apparatus.* Patent dated July 31, 1850.

Mr. Bessemer's improvements consist—

1. In the employment of a centrifugal filtering apparatus for separating from cane-juice, immediately after it has been expressed, the fragments of cane, which, to a greater or less extent, are invariably found mixed with it.

2. In again employing the centrifugal filter to operate on the filtered cane-juice, after it has been defecated by any of the usual methods, and separating from it any solid or coagulated matters which may be suspended in it.

3. In the employment of centrifugal force to facilitate the evaporation of the aqueous particles of the clarified juice, by raising the juice inside a tube in the centre of the boiling vessel. The upper part of this tube is perforated with numerous small holes, through which the juice is by the rotary motion of the tube dispersed in a shower over the whole area of the evaporating vessel, and thus, owing to the large surface presented, the process may be conducted at a lower degree of temperature, and with greater rapidity than when the surface of the liquid under evaporation is equal only to the area of the vessel employed.

4. In the application of two modifications of the before mentioned centrifugal filtering apparatus to the refining of sugar, for separating from the syrup any coagulated matters that may be present in it after the process of "blowing up," and preparatory to its being passed through the charcoal filter.

5. In various improvements in centrifugal apparatus employed to separate the crystals from the liquid and other matters with which they are mixed—parts of these improvements having for their object to reduce the vibratory motion communicated by such machines to the buildings in which they are worked—and other parts relating to methods of introducing and withdrawing the feed, to methods of connecting such machines with the prime mover, and to the construction of the drums.

Mr. Bessemer also specially claims—

1. Suspending the drum by universal ball joints, and by a ball joint and balancing ring.

2. The use of elastic packing between the bottom of the machine and the floor on which it rests, to reduce vibration.

3. The application of leather bushes to the spindle, and of vulcanised India-rubber rings, to encircle the bushes in which the axle revolves, in order to prevent tremor and wear of the machine.

4. Making the spindles of hollow cones of sheet iron.

5. Removing the drum to be discharged of its contents, and replacing it immediately with another, charged with matter to be operated on, and making the bottom of the drum of a hollow or dished form, to contain the matter to be operated on before the machine is caused to rotate.

6. Discharging the drum by centrifugal force.

7. Fixing the drums on the axis of an emissive engine.

8. Constructing the drum with external and internal grooves at right angles, and with conical perforations.

9. The use of a brush of wire, or other suitable material, for keeping the perforations of the drum clear and unclogged.

George Thompson, of Park-road, Regent's-park, gentleman. *For certain improvements in machinery and apparatus for cutting, digging, or turning up earth applicable to agricultural purposes.* Patent dated August 12, 1850.

Mr. Thompson's machine, as described and claimed in his specification, consists of a rectangular frame mounted on wheels and supporting two cranked axles, on which are fixed spades or cutters, which are so guided in their movements that the upper part of the stock of each has a rectilinear, and the lower part a curvilinear motion. The cranks on the axles are at right angles to each other, and the spades on that axle in the rear of the machine act on the earth which was left undug by those on the front one. There are also receivers for the earth thrown up by the spades, which take a position to catch the earth as the spades are about to retire, and turn over and discharge it when the spades commence their downward movement. This machine may be set in motion by steam power, either stationary or attached to it. In some cases a row of coulters is attached to the front of the machine to act on the earth before the spades come into operation.

Henry Meyer, of the Strand, gentleman. *For certain improvements in power-looms for weaving.* Patent dated August 10, 1850.

The improvements claimed under this specification are—

1. A method of changing the shuttles.

2. A method of imparting a peculiar motion to the treadles.

3. A regulator for regulating the taking-up of the work.

4. An arrangement of apparatus for stopping the loom when the weft is broken or finished.

The movements of the shuttles are controlled by a Jacquard attached to the loom.

Armand Nicholas Freche, merchant, of Paris. *For improvements in obtaining power.* Patent dated August 12, 1850.

These improvements consist in a "self-acting" combination of levers and wheel gearing, so arranged that the impetus created by the successive falling of weighted levers is transmitted to a driving shaft, and increased in transmission according to the weight applied to the ends of the levers. (!!)

No claims. (Needless.)

Jean Louis Pascal, of Moorgate-street, London, civil engineer. *For an improved apparatus for the cure or prevention of smoky chimneys, and also for the ventilation of ships, rooms, and buildings in general.* Patent dated October 24, 1850.

The arrangement by which Mr. Pascal proposes to effect these objects consists in enclosing the tube through which the smoke ascends, or by which the chamber in connection with it is to be ventilated, in an external casing, at the lower end of which are fixed inclined curved plates of metal, which connect the tubes together, and at the same time serve to produce a current of air, and cause it to ascend between the external and internal tubes. At the top is placed a screw composed of three or four vanes, which is caused to rotate on its axis by the ascending rarefied air, by the current between the casings, or by both combined, and to act as an exhauster.

Claim.—An apparatus composed of three or four plates or vanes (parts of a screw), which are caused to revolve on their axis by the ascending currents, and to act as an exhauster.

List of Provisional Registrations under the New Act (13 and 14 Vic., 14 Aug. 1850.)

Jan. 2	1	J. P. Oates	Litchfield	Equitone cornet
,,	2	A. A. De R. Heley,	Manchester-buildings, Westminster	Fastener for gloves.
8	3	R. Brotchie	Regent-street, Lambeth	Wet repellant boot.
10	4	Henry Wickens	Regent-street	Border piece or edging for a parasol.
11	5	Henry Smith	Rufford's-row, Islington	Horticultural hot-water gas stove.
14	6	Theodore Jones	Lombard-street	Silent alarm bedstead.
15	7	W. M. Bywater	Piccadilly	Water meter.
16	8	J. P. Oates	Lichfield	Military transposing trumpet.
17	9	Benjamin Browne	Belvedere-row, Lambeth	Lock and key.
18	10	James Creak	Wisbech	Waterproof Blucher boot.
,,	11	James Creak	Wisbech	Waterproof button boot.
21	12	Frederic Futvoye	Regent-street	Postage stamp envelope.
22	13	Peter Chalmers	Chamber-street, Goodman's-fields	Ale drum.
,,	14	Richard Clayton	Gresham-street	Swimming glove for all ages and nations.
24	15	G. J. Newbery	New Oxford-street	Door wedge.
,,	16	Richard B. Beauford	Saint Leonards and Hastings.	Daguerreotype accelerator.
,,	17	Lieutenant Julius Roberts, R.M.A.	Portsmouth	Self-acting swing pier.
25	18	William Rodgers	St. Mary's-street, Walcot-square	Bolt protector for buttons and medals.
27	19	John Coope Haddan	Bloomsbury-square	Lining or substitute for padding for a railway carriage.
28	20	John Lee Stevens	Copthall-buildings	Fire shovel.
,,	21	John Lee Stevens	Copthall-buildings	Nipping end of fire tongs.
29	22	Charles Saunders	New-yard, Great Queen-street	Double lever wheel plate.
,,	23	W. Dyne C. J. Vickery	Mansfield-street, Kingsland-road Mason-street, New-cross	Life-boat.
30	24	Hyam Hyams	Cornhill	Object-glass.
31	25	William Bishop Robert Cooke	Boston Huntingdon	Elastic tightener for trousers.
Feb. 3	26	Jean F. C. Noel	Bedford-street, Strand	Meldoise bridle.
4	27	Andrew Wentzell	Fore-street, Lambeth	Life-boat
5	28	William Bishop Robert Cooke	Boston Huntingdon	Horse collar.
6	29	David Stephens Brown	Alexandrian-lodge, Old Kent-road	Filtering jug.
,,	30	Edward Gibbons Cooper	Westbourne-street, Pimlico	Swimming gloves and life preservers.
,,	31	David Stevens Brown	Alexandrian-lodge, Old Kent-road	Fumigating cover.
6	32	Samuel Thomas Scott	Union-street, Southwark	Adjusting last.
,,	33	M. Hyams and Co.	Long-lane, Smithfield	Exhibition cigar.
7	34	William Bishop R. Cooke	Boston Huntingdon	Elastic tightner to stays.
,,	35	Uriah Scott	Upper Charlton-street, Fitzroy-square	Silent door and gate spring.
,,	36	Thomas Robert Hill	Church-street, Soho	Portable bedroom-door fastener.
8	37	W. M. Bywater	Piccadilly	Shifting draught eye.
,,	38	Thomas Cooke Foster	Newcastle-street, Strand	Hat.
,,	39	George Gregory Lowe	High-street, Portland Town	Self-cleansing sanatory cistern.
,,	40	William Pierce	Manchester	Imperial copying press.
,,	41	John Coope Haddan	Bloomsbury-square	Handle apparatus for omnibus roof.
,,	42	John Lee Stephens	Copthall-buildings	Screw runner fastening for umbrellas and parasols.
,,	43	J. S. Mackenzie	Newark-upon-Trent	Vulcan spring for doors.
,,	44	Etienne F. Lorentz	Bedford-street, Strand	Rechaud chaufferette, or stove-foot-warmer.
10	45	S. J. Wilkinson G. V. Wiesdell	Jeffrey-square, St. Mary-Axe. Walworth-road	Secure fastener.
,,	46	Thomas Gowland	Leadenhall-street	Spring-catch fastener for brooches.
,,	47	Frederick Huxam Charles Huxam J. A. Brown,	Exeter	Cooking stove.
,,	48	Etienne F. Lorentz	Bedford-street, Strand	Rechaud bruloir, or stove coffee roaster.
,,	49	Etienne F. Lorentz	Bedford-street, Strand	Rechaud rotissoire, or roasting stove.

LIST OF SCOTCH PATENTS FROM 22ND OF DECEMBER TO THE 22ND OF JANUARY, 1851.

James Hill, of Stalybridge, Chester, cotton spinner, for machines for preparing cotton, wool, and other fibrous substances, for spinning and doubling. January 3; four months.

Henry Bessemer, of Baxter-house, St. Pancras-road, Middlesex, engineer, for certain improvements in apparatus acting by centrifugal force, in the manufacture of sugar, and other improvements in the treatment of saccharine matter by such apparatus. January 6; six months.

Lucien Vidie, 14, Rue du Grand Chantier, Paris, French advocate, for certain improvements in measuring the pressure of air, steam, gas, and other liquids. January 8: four months.

John Coope Haddan, of Bloomsbury-square, Middlesex, engineer, for improvements in the manufacture of railway carriages, railway wheels, and also of panels for carriages, and other purposes. January 9; six months.

Samuel Hall, of Barford, near Nottingham, engineer, for improvements in the manufacture of starch and gums, and in furnaces and steam boilers, with safety apparatus to be used in such manufacture, and for other purposes. January 10; six months.

John Corry, of Belfast, Ireland, damask manufacturer, for improvements in machinery or apparatus for weaving figured fabrics, which machinery or apparatus is also applicable to other purposes for which jacquard apparatus is or may be employed. January 13; six months.

John Ransom St. John, of the city and state of New York, America, engineer, for improvements in the process of, and apparatus for, manufacturing soap. (Being a communication.) January 15; six months.

John Clarkson, Milns, and Samuel Pickstone, of Radcliffe Bridge, Lancaster, manufacturer, for certain improvements in machinery or apparatus used in spinning, doubling, and weaving cotton, flax, and other fibrous substances. January 20; six months.

Joseph Gibbs, of Devonshire-street, Middlesex, engineer, for improvements in manufacturing paints and cements, and panels or surfaces on which paints and cements are or may be applied, parts of which improvements are applicable to other useful purposes. Januaay 20; six months.

Edward Clarence Shepard, of Parliament-street, Westminster, gent., for certain improvements in electro-magnetic apparatus, suitable for the production of motive power, of heat, and of light. (Being a communication.) January 22; Six months,

LIST OF IRISH PATENTS FROM 21ST OF DECEMBER TO THE 19TH JANUARY, 1851.

William Henry Green, of Basinghall-street, London, gent., for improvements in the preparation of peat, and other ligneous and carbonaceous substances, and the conversion of some of the products derived thereby, and also in the application of some of such products to the preservation of substances liable to decomposition and destructive agencies, and which mode is also applicable to other products of a similar nature. December 21.

Peter Wood, of the firm of Thomas Bury and Co., dyers, calenderers, and finishers, Adelphi Works, Salford, Lancaster, for improvements in figuring and ornamenting woven and textile fabrics, paper, wood, leather, and all kinds of materials, substances, or compositions, and in machinery employed therein. December 24.

Henry Bessemer, of Baxter-house, St. Pancras-road, Middlesex, engineer, for certain improvements in apparatus acting by centrifugal force, in the manufacture of sugar, and other improvements in the treatment of saccharine matter by such apparatus. December 31.

Charles William Lancaster, of New Bond-street, Middlesex, gun-maker, for improvements in the construction of fire-arms, cannon, and projectiles, and in the manufacture of percussion tubes. January 3.

Joseph Eccles, of Moorgate Fold Mill, Lancaster, cotton spinner and manufacturer, and James Bradshaw and William Bradshaw, of Blackburn, in the same county, watch makers, for certain improvements in, and applicable to, looms for weaving various descriptions of plain and ornamental textile fabrics. January 4.

George Edward Dering, of Lockleys, Herts, esquire, for improvements in the means of, and apparatus for, communicating intelligence by electricity. January 4.

James Thomson, of Glasgow, Lanark, civil engineer, for improvements in hydraulic machinery, and in steam engines. January 10.

William Thomas Henley, of Clerkenwell, Middlesex, philosophical instrument maker, for certain improvements in telegraphic communication, and in apparatus connected therewith, parts of which improvements may be also applied to the moving of other machines and machinery. January 18.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in apparatus for milking animals. February 10; six months.

Peter Fairbairn, of Leeds, machinist, and John Hetherington, of Manchester, machinist, for certain improvements in mouldings for casting pipes, railings, gates, agricultural implements, and other metal articles; and also in preparing patterns or models for the same. February 10; six months.

Richard Stuart Norris, of Warrington, Lancaster, civil engineer, for certain improvements in the construction of the permanent way of railways, bridges, locks, and other erections wholly or in part constructed of metal; also improvements in breaks for railway carriages. February 10; six months.

John Stephens, of the Allyards, Astley Abbotts, Salop, gentleman, for certain improvements in threshing machinery. February 10; six months.

Joseph Haythorne Reed, late of the 17th Lancers, of the Harrow-road, gentleman, for improvements in saddlery and harness. February 10; six months.

John Harcourt Brown, of Fir-cottage, Putney, Surrey, gentleman, for certain improvements in the construction and building of ships, boats, buoys, rafts, and other vessels, and appliances for preserving life and property at sea. February 10; six months.

Charles Xavier Thomas (de Colmar), Chevalier de la Legion d'Honneur, of Paris, France, for an improved calculating machine, which he calls "Arithmometer." February 10; six months.

William Weild, of Manchester, engineer, for improvements in machinery for turning and burnishing. February 11; six months.

Benjamin Heywood, of Water-street, Manchester, coach-builder, for certain improvements in railway and other carriages. February 11; six months.

George Briand, of Nicholas-lane, London, surveyor, and Richard Fell, of the City-road, engineer,

for certain improvements in obtaining fresh and pure water from salt, sea, and other waters. February 11; six months.

Charles Howland, of New York, America, engineer, for improvements in bell telegraphs. (Being a communication.) February 11; six months.

Angier March Perkins, of Francis-street, Regent-square, Middlesex, for improvements in constructing and heating ovens. February 11; six months.

James Webster, of Leicester, engineer, for improvements in the construction and means of applying carriage and certain other springs. February 11; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Feb. 6	2671	George Taylor	Wolverhampton	Self-correcting date clock.
,,	2672	Stock and Son	Birmingham	Soil-pan service-box.
,,	2673	William Pulford	Boston	Railway carriage roof candle-lamp.
8	2674	John Stafford Mackenzie	Newark-upon-Trent	Triturator.
,,	2675	Samuel Salter	Watford	Opening and valve for admitting air from the ash-pit of a furnace, so as to inflame the products beyond the bridge of such furnace.
,,	2676	William and John Sangster	Cheapside	Apparatus for destroying insects on trees.
10	2677	George Knowles	Wood End, Scarborough	Illuminating gas-stove.
,,	2678	Carnell and Hosking	Perran Foundry, Cornwall	Treble beat hydraulic valve.
,,	2679	Charles Frederick Trelawney Young	Stockleigh, Pomeroy	Rotary boot and shoe-cleaner.
,,	2680	Charles Hubert	Regent-street	Shape for cutting the front and quarters of a boot in one piece.
11	2681	Henry Andrew Dewar	Aberdeen	Hinged clasp for holding artificial teeth.
,,	2682	Roberts and Hall	Sheffield	Toast rack.
12	2683	B. and J. Harcourt	Birmingham	Match-box.
,,	2684	Wassall and Pitt	Birmingham	Universal penholder.
,,	2685	John H. Hutchinson	Grantham	Sieeve lining for garments.
,,	2686	John Macintosh	Robert-street, Adelphi	Apparatus to be used to make boats more safe at sea.
,,	2687	Carnell and Hosking	Perran Foundry, Cornwall	Treble beat hydraulic valve.

CONTENTS OF THIS NUMBER.

White's Patent Crushing and Expressing Press.—Specification.—(*with engravings*) 121
Description of Mr. Lassell's Machine for Polishing Specula—(*with engravings*) 124
Mr. James Thomson's Patent Water-wheels.—Letters from Dr. Schinz and Professor William Thomson 126
Paine's Light.—Experimental Investigation of the Effect of Passing Hydrogen Gas through Turpentine 128
Water Gas.—Shepard's Patent 129
The Heliograph 129
Mode of Lighting Lamps of Great Height.—By Mr. John Ayliffe.—(*with engravings*) 130
Safety Book-case. By John MacGregor, Esq.—(*with engravings*) 131
Electric Telegraph Company. — Application for Extension of Patent 131
Advent of the Arts. By William Ewbank, Esq., American Commissioner of Patents ... 132
English Specifications Enrolled during the Week:—
Rotch .... Soap 133
Gywnne .... Motive Power 134
Melville & Callow ... Fire-arms 134
Steele .... Cooling Metals 134
Massiah .... Artificial Marble 135
Kane .... Chairs 136
Cadby .... Musical Instruments 136
Bessemer .... Centrifugal Sugar Machine 136
Thompson .... Tilling Machines ... 137
Meyer .... Power Looms 137
Freche .... Ventilation 137
Pascal .... Smoky Chimneys 137
List of Provisional Registrations 138
Monthly List of Scotch Patents 139
Monthly List of Irish Patents 139
Weekly List of New English Patents 139
Weekly List of Designs for Articles of Utility Registered 140

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Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. CARNELL AND HOSKING'S TREBLE BEAT HYDRAULIC VALVES.

Fig. 2.

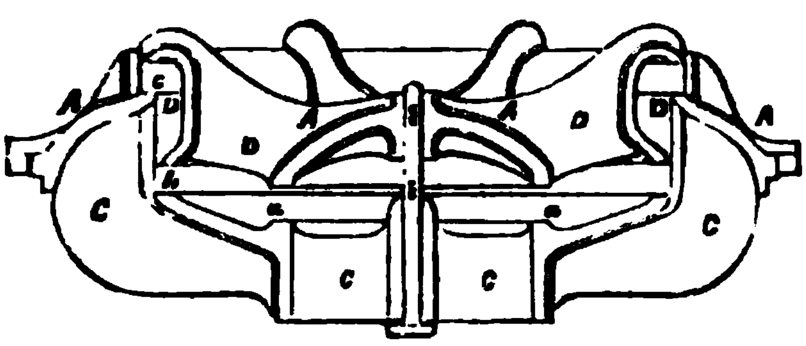


Fig. 1.

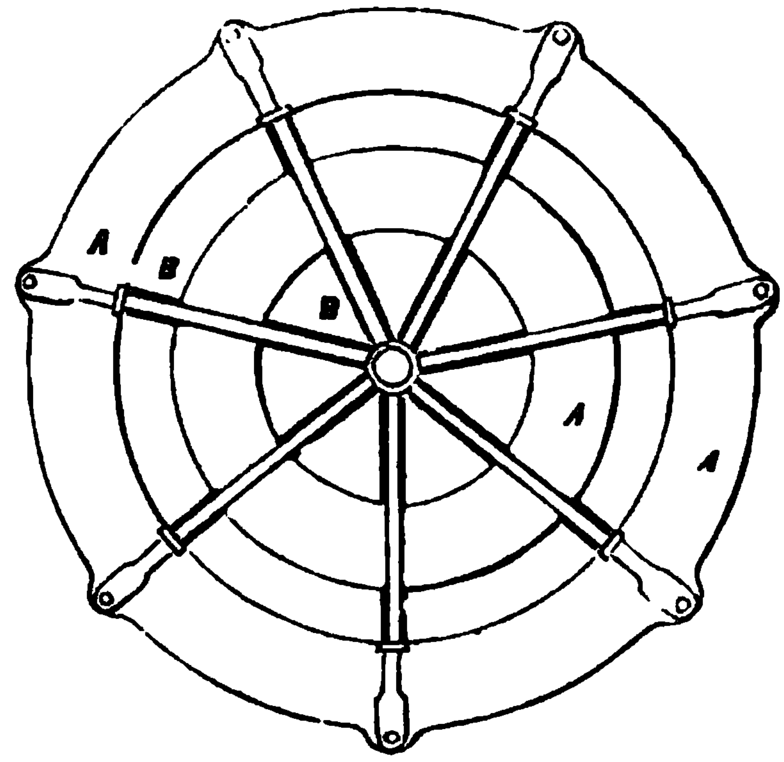


Fig. 4.

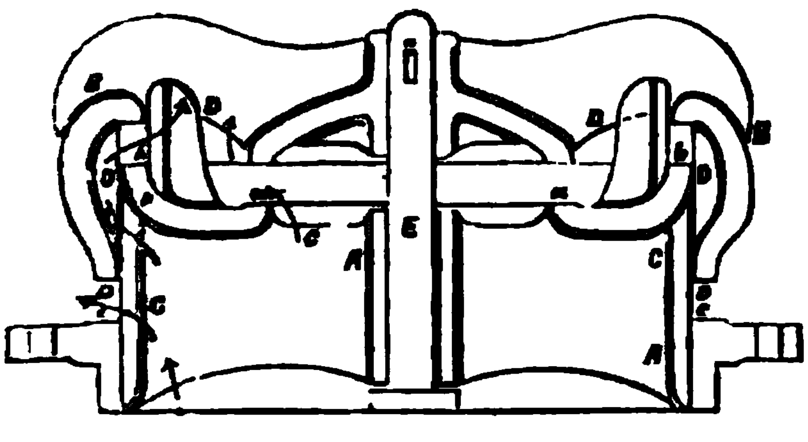
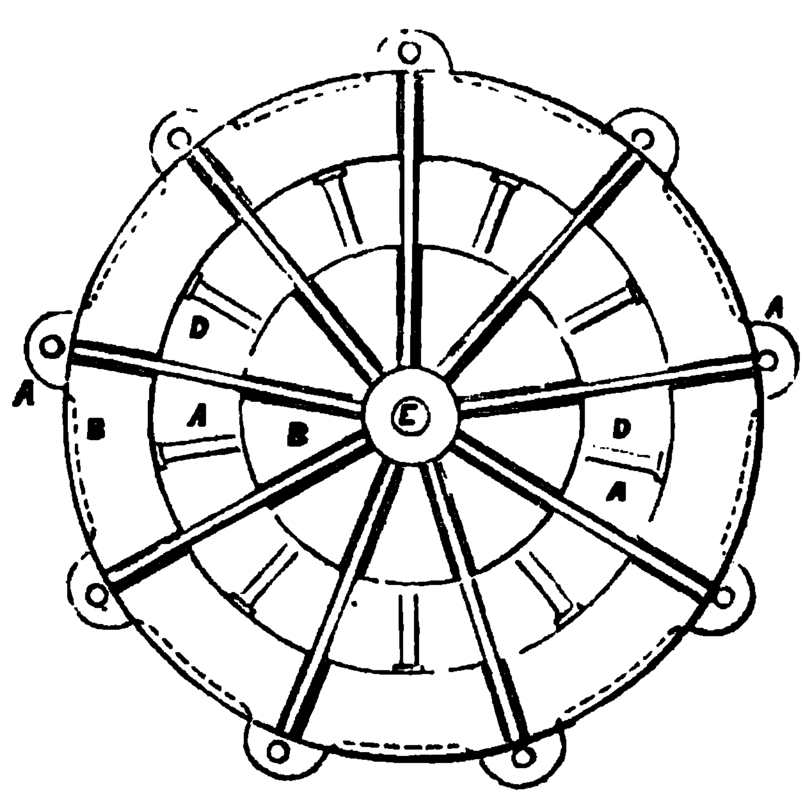


Fig. 3.



MESSRS. CARNELL AND HOSKING'S TREBLE SEAT HYDRAULIC VALVES.

(Registered Under the Act for the Protection of Articles of Utility. Messrs. Carnell and Hosking's, of the Perran Foundry, Cornwall, Proprietors.)

Two varieties of these valves have been registered; one of which is represented in figs. 1 and 2, and the other in figs. 3 and 4. Figs. 1 and 3 are top elevations, and figs. 2 and 4 vertical cross sections.

A is in each case the valve seat; B, the valve; CC, the passages through the seat, and DD, passages through and around the valve; E is the guard or stop to prevent the valve from being thrown out of its seat by any sudden or unusual action of the engine.

In figs. 2 and 4 the valve is shown in its open position, and the arrows indicate the course taken by the water in passing through it; *aa*, *bb*, *cc*, are the seats or bearing surfaces.

The most prominent advantage offered by these valves, is the larger opening for the passage of the water than is afforded by the valves of the forms hitherto in use, while at the same time the lift is reduced, and consequently the concussion very considerably lessened.

CHEVALIER CLAUSSEN'S IMPROVEMENTS IN THE PREPARATION OF FLAX AND IN BLEACHING.—THE SPECIFICATION.

We have now the pleasure (exclusively we believe) of laying before our readers the specification at length of the important improvements in the preparation of flax, by Chevalier Claussen, which have recently attracted so large a space of public attention, and were emphatically referred to by Sir James Graham in the Free Trade Debate in the House of Commons (Feb. 13), as giving promise of a new career of prosperity to both the farmers and manufacturers of this country. Sir James had been present the day before, at a Meeting of the Council of the Royal Agricultural Society, when a long and interesting paper on the subject, by Chevalier Claussen, was read, but which did not enter into any of the details of the new processes by which the improvements in question are effected. The paper, after treating, first, of the reasons in favour of an extended cultivation of flax and hemp in the United Kingdom—of which the chief are, the relief it would afford to the agricultural interest, the deficiency of the existing supply of cotton, and our dependence for even that limited supply on foreign countries—then proceeded to show the suitableness of our climate and soil to the growth of these plants, and the large profits which the landowner and farmer might fairly anticipate from an application of their industry in this direction. The existing processes were next discussed; and as a knowledge of these is very necessary to a clear comprehension of the value of the improvements which Chevalier Claussen has introduced, we extract the following particulars from this part of his paper:—

Under the system of preparing the flax, hitherto followed four modes of steeping or "retting" the plant are resorted to. The first consists of the plan of *dew retting*, or allowing the flax to remain exposed on grass land for a considerable number of days exposed to the action of the rain, dews, and atmosphere. The plan, however, is one which, from its obvious inconveniences, is not calculated to meet with general approval in the present advanced state of agriculture, and is indeed very rarely adopted.

Probably the best mode of steeping the flax is that of placing it *in running streams*, according to the mode adopted in Courtrai, the principal flax-growing district of Belgium. The flax so prepared generally realises a much higher price than any other description of flax. There are, however, certain peculiarities in the water of the river Lys which makes it admirably adapted for steeping purposes, and which are not possessed by any streams in this country. Independent of the peculiarities of the water, the steeping of flax in running streams cannot be made generally available in this country, as they are mostly too rapid in their character.

In the absence of suitable streams, recourse is had to a mode of *steeping in pits or pools*. But so many favourable conditions are required to be obtained, and so many unfavourable ones to be avoided, in

the selection of the site for the pool, and the supply of the water required, that it is probable a desirable or perfect steep pool could not be formed in any part of the country. The soil forming the bottom and sides of the pit will have an influence on the colour of the fibre; clay, gravel, alluvial and peaty soil, will each impart some peculiar dye to the material, which more or less affects its value. The water used in the pit or pool must not be spring water, and it must not have flowed over any soil containing metallic deposits; and rain-water is not well calculated for the purpose. But, in addition to all these difficulties attendant upon obtaining the requisite means, the grower of flax has to contend against all the uncertainties and risks of either over or under-steeping his flax. "One sultry night," says one of the reports of the Royal Flax Society, "while it is in the steep, and nearly rotted sufficiently, is enough to carry the fermentation beyond the safe point. So much is this feared by farmers, that almost all flax is underwatered; and although much of it is afterwards watered on the grass, yet the great proportion is brought to market with the shoves still unseparated in bits on the fibres." But while the sultry nights of summer are unfavourable to the steeping of flax, and inconvenient to the farmer, inasmuch as his labourers are at that season generally otherwise employed, it is also obvious that during the winter, when comparatively little farm labour is carried on, the process of steeping must be discontinued altogether, in consequence of the temperature.

A fourth process has within the last few years been very strenuously advocated by the Royal Flax Society in Ireland, which consists in *steeping the flax in hot water.* This mode (Shenck's), although doubtless an improvement upon any of the existing plans, still does not afford the means of obtaining that complete separation of the fibres which it is desirable to obtain.

* * * *

Not only is the present process of steeping inconvenient and unnecessary, but it is highly injurious, as it imparts its injurious dyes to the fibre, deteriorates it, and gives to it an inequality of strength, which in the subsequent stages of manufacture, are exceedingly difficult to be overcome. I have found this to be more particularly the case in the preparation of the flax into a material capable of being spun alone or in combination with wool and cotton upon the existing machinery.

The more striking features of Chevalier Claussen's process, as distinguished from the preceding, were stated to be these:

1. That by this process the preparation of long fibre for scutching is effected in less than one day, and is always uniform in strength and entirely free from colour, much facilitating the after process of bleaching either in yarns or in cloth.

2. That he can also bleach it in the straw at very little additional expense of time or money.

3. That in consequence of a more complete severance of the fibres from each other, and also from the bark and boon, the process of scutching is effected with half the labour usually employed.

4. That by the new process flax is rendered capable of being spun, either in whole or in part, on *any existing spinning machinery.*

5. That the fibre to be mixed with cottons or spun alone on cotton machinery, is so completely assimilated in its character to that of cotton, that it is capable of receiving the same rich opaque colour that characterises all dyed cotton; and, consequently, any cloth made from flax-cotton yarn can be readily printed, dyed, or bleached by the ordinary cotton processes.

6. That with respect to the advantages of being able to spin flax in combination with wool, on the existing woollen machinery, the first is, that the flax prepared by M. Claussen is capable of being "scribbled," "spun," "woven," and "milled," in all respects as if it were entirely wool; having an advantage in this respect over cotton, which has not the slightest milling properties; on the contrary, the flax fibre is capable of being even made into common felt hats with or without an admixture of wool. To such an extent has the milling property of flax been proved, that a sample of cloth was exhibited which had been woven to 54 inches wide, and milled up to 28 inches wide.

7. That the flax-fibre will not, under any circumstances, when prepared for spinning with wool, cost more than from 6d. to 8d. per lb., while the wool with which it may be mixed will cost from 2s. to 4s. per lb.; consequently reducing the price of cloth produced from this mixture 25 or 30 per cent. below the present prices of cloth made wholly from wool, and being of equal, if not greater, durability.

8. That short-wool refuse, which cannot by itself be spun into a thread, may, by being mixed with this thread, be readily spun and manufactured into serviceable cloths.

9. That by this process flax may be also

so prepared as to be spun in any certain proportions, with silk upon the existing silk machinery; that when so spun, it is capable of receiving considerable brilliancy of tint. That the fibre may be prepared for thus spinning at an uniform price of from 6d. to 8d. per lb. That as it may be spun in any proportions with silk, it is evident that the price of the yarns must be reduced according to the relative proportions of the materials employed; thus extending the markets, and giving increased employment to the operatives.

In evidence of these advantages, the Chevalier laid before the Meeting the following specimens:

1. Samples of flax in the straw pulled and rippled.
2. Sample of flax-straw, prepared according to the new process, adapted for linen manufacturers.
3. Sample of long fibre scutched from the above.
4. Samples of pure flax-fibre, or "British cotton," adapted for spinning on cotton machinery.
5. Sample of yarn spun on cotton machinery, some from all flax-fibre, others mixed in various proportions with American cotton,—these mixtures being termed by the inventor flax-cotton.
6. Samples of flax-fibre prepared for mixing with wool.
7. Samples of yarn produced on ordinary woollen machinery, composed of wool and flax in various proportions, termed by the inventor flax-wool.
8. Samples of flannel woven from the above.
9. Samples of fine cloth woven from yarn composed of flax and fine wool in various proportions, and dyed.
10. Flax-fibre prepared for mixing with silk, and dyed of various colours.
11. Flax-fibre mixed with spun silk, and termed by the inventor flax-silk.
12. A sample of yarn produced from the above.
13. Samples of flax-cotton yarn dyed of various colours.
14. Samples of cloth woven from flax-cotton yarn and wool, dyed.

We shall now proceed to give Chevalier Claussen's specification itself; but before doing so, may point out to the reader that the Chevalier's patent embraces, besides his improvements in the preparation of flax and hemp, and in yarns made from these and other materials, some new processes in bleaching generally, which appear to be only second in importance to those relating to flax; since by one of them (the ingenious double decomposition process) the same bleaching liquors may be used over and over again, without any other loss than necessarily attends their manipulation.

The Specification.

Firstly, my said invention, in so far as respects improvements in bleaching, has reference to the bleaching of all kinds of vegetable productions, and of fabrics or articles composed of such productions, and consists of the following improved processes.

In the usual methods of bleaching fabrics, such as calico, the goods are first immersed in a bleaching liquor (commonly the solution of hypochlorite of lime, the "chloride of lime" of commerce), and then are steeped in a bath of water, acidulated with sulphuric acid. By this plan the chlorine is set free, either in its simple form or in combination with oxygen (as chlorous or hypochlorous acids), or in chemical union with the hydrogen of the water (as hydrochloric acid), and thus either is wasted, by its escape, or is rendered injurious to the fabric, by remaining too long in contact with it.

Now, instead of this, I adopt the following process, whereby the whole, or a great portion of the chlorine, or chloro-compound, is kept in a combined state, and recovered for future use. By the term "*chloro-compound*," I do not mean a *salt containing "chlorine*," but an acid having "chlorine" for its base, such as chlorous or hypochlorous acids.

In this process, then, of bleaching, I take the goods, after they have passed through the bleaching liquor (say a solution of the hypochlorite of lime), and then steep them in a strong solution of some salt, whose acid has a more powerful affinity for lime than hypochlorous acid; thus a strong solution of sulphate of magnesia may be employed, the sulphuric acid of which, having a strong affinity for lime, combines with the earthy base of the bleaching salt above-mentioned, and forms sulphate of lime, and the chloro-compound being thus liberated, unites with the magnesia of the sulphate of magnesia, and forms a new salt (hypochlorite of magnesia), having bleaching properties similar to the lime salt first employed.

This newly-formed compound may be, in the next instance, used as a *primary bleaching agent*, and may again be subjected to the process of double decomposition, as in the foregoing example. Thus, the goods

having been exposed to the action of hypochlorite of magnesia in solution, may then be steeped in a liquid holding in solution some carbonate or other salt, for whose base the hypochlorous acid has a greater affinity than for the magnesia. In such a case, the carbonic acid having also a strong attraction for the magnesia, combines with it, to form a carbonate of that earth, and the liberated chloro-compound, instead of escaping, or remaining so long in contact with the goods as to injure them, combines with the base of the carbonate employed to produce decomposition, and forms a new salt having bleaching properties. This salt may also be brought under the same laws of double decomposition, as exemplified before, and with similar results. Thus, if the carbonate employed in the foregoing instance had been carbonite of barytes, and a solution of sulphate of magnesia, or of lime, were brought into contact with the resulting chloro-compound salt of barytes, a precipitate of the base as a sulphate of barytes will take place, and the chloro-compound will unite with the lime or magnesia, to form a bleaching salt.

I would mention, however, that, in bleaching flax, or other like vegetable material for making linen, no compounds should be used which are likely, during their decomposition, to evolve any gaseous matters such as carbonic acid or chlorine, as, by their development and expansion in the fibrous tubes, the flax, or any similar material, would be rendered not so fit for spinning with the ordinary flax-spinning machinery; but in bleaching flax, or any similar material which is to be combined with other materials for spinning and felting according to my invention, compounds evolving gas may be safely used, as I shall hereafter more fully specify and explain.

For the purpose of bleaching by the method of double decomposition, I do not confine myself to the compounds already mentioned as examples, nor to any particular salts or class of salts; but I claim a right to use any which, when placed under the like circumstances, as before exemplified in the case of goods treated by the hypochlorite of lime and the sulphate of magnesia, will be subject to the same chemical law of decomposition, and will produce the same result.

However, I may particularise as among the salts suitable for decomposing the chloro-compound salts, or assisting themselves in the process of bleaching, the carbonates (such as the carbonate or bicarbonate of soda), sulphates (as sulphate ot magnesia, &c.), nitrates (as nitrate of soda, &c.), acetates (as acetates of potash and of lead, &c.), prussiates (as prussiates of potash, &c.), chromates (as chromate and bichromate of potash, &c.), tartrates (as tartrate and bitartrate of potash, &c.); but I repeat, that I do not confine myself to these which are merely given as examples.

Another mode of bleaching which I sometimes employ, and which is especially applicable to goods composed of both animal and vegetable fibres, is as follows:—I take the goods, after they have been steeped in any of the ordinary bleaching liquors, such as the solution of hypochlorite of lime (chloride of lime), and while they are still wet I expose them to the fumes of sulphur, slowly burning in a suitable chamber or stove. In this case, I have two powerful bleaching agents at work, viz., the hypochloritic compound and the sulphurous acid produced by the combustion of the sulphur. A portion of the sulphurous acid combines with the base of the chloro-compound salt, to form a sulphite of lime or magnesia, as the case may be, and a small portion of sulphuric acid may also in this case be formed, which, with the earth or base, would form a sulphate. In this way the chlorine, or chloro-compound, remaining in the wetted goods is liberated, and allowed to act freely upon the articles to be bleached. In this last method of bleaching I have ascertained that there may be occasionally substituted for the ordinary and known bleaching liquids, certain chromates, manganates, and hypermanganates, &c.

Secondly. My improvements in the preparation of materials for spinning and felting have special relation to flax and hemp, and other plants to which the same may be applicable; and the processes I use to prepare the same, though possessed of some features common to the whole, vary according to the purposes to which the fibre obtained from the said materials is to be applied—that is to say, according as the fibre is required to be long or short, fine or coarse, and the machinery in which it is to be spun is adapted to the spinning of one or other sort of fibre.

By the term "*fibre*," as used throughout the specification, I mean that portion of each plant which is capable of being spun or felted; and my invention applies to the "fibre" surrounding the stems of dicotylidenous plants, and to that existing in the stems and leaves of monocotylidenous plants.

In the following exemplifications of my improved modes of preparation, I shall throughout suppose flax or hemp to be the material operated upon.

If I have to deal with the plant from the

time of its being first cut down or pulled for use, I take it in the state of straw (after the seed has been stripped from it), and subject it to the following, which I call my "primary process:"—

I first steep the straw in a solution of a caustic alkali of about one degree of Twaddel's hydrometer, and for such a length of time as may be most convenient. If despatch is required, I use the solution in a boiling state; in which case an immersion of about six hours is sufficient. If more time can be conveniently allowed, I employ a solution of a temperature of about 150° Fahrenheit, and prolong the immersion for about twelve hours; and so in proportion to the degree of temperature. The solution may be even used at a lower temperature, with a corresponding prolongation of time, but in no case need the immersion exceed a couple of days at the utmost.

The object of the preceding treatment is twofold:—First, to decompose, dissolve, or remove (more or less, as required) the glutinous, gummy, or other matters which connect the fibre with the woody portions of the plant; and, second, to discharge or decompose any oleaginous, colouring, or extraneous matter contained in the straw, without allowing the matters so discharged to stain the fibre; and these results are obtained by the action of the alkaline solution.

In the preceding mode of preparing vegetable materials, I generally use a solution of caustic soda; but other alkaline liquors will answer the purpose,—such as a solution of caustic potash, or of lime dissolved in or diffused in water; or, indeed, any substance having the like power of removing, discharging, or decomposing the colouring, glutinous, gummy, or other foreign matters contained in the straw, and which would interfere with the whiteness of the fibre, or with its ready separation and manufacture.

If the fibre is required to be long, like that now commonly spun in flax machinery, I subject the straw to a second process, for the purpose of getting rid of any of the alkali still adhering to the straw or fibre, and for the purpose of completing (if necessary) the removal of any glutinous, gummy, colouring, or extraneous matters.

To this end I take the straw from the alkaline solution, and steep it for about two hours in water acidulated by sulphuric acid in the proportion of about one part of the acid to from two to five hundred parts of water. Some other dilute acids will also answer this purpose, such as dilute muriatic acid, &c.; but sulphuric acid is to be preferred. Or, I transfer the straw, while yet wet with the alkaline solution, to a suitable chamber or stove, where I subject it to the action of sulphurous acid, or the fumes produced by the slow combustion of sulphur. In both cases the acid combines with any free alkali, remaining on the straw or fibre to form a sulphite or sulphate, according to the acid employed; while an excess of either sulphuric or of sulphurous acid will complete the decomposition, discharge, or removal of the glutinous, colouring, and other matters.

I next remove the straw from the acid bath, or sulphur-chamber, or stove, and wash or otherwise treat it with water, till all soluble matters are removed.

If the fibre is required to be decolorised, the straw may now be exposed to one of the bleaching processes which I have already described, or to any of the other known bleaching processes. It may then be dried, and made ready for breaking and scutching by the means ordinarily followed in the manufacture of long flax.

I would mention here that, in some cases, it will be found advantageous to pass the straw between rollers, or to break it roughly or partially, before subjecting it to the process above described, for the purpose of facilitating the action of the chemical agents upon it.

By the aforesaid method, I am enabled to remove from the straw certain matters which water alone cannot discharge. The fibre thus prepared is also freer to heckle, and the straw more easy to scutch, than fibre and straw treated in the ordinary way. Much time and much material are also saved; while the noxious exhalations attendant upon the water-rotting system are wholly prevented.

If the fibre is required to be short, so that it may be felted or carded, and adapted for spinning on cotton, silk, wool, worsted, or tow, spinning machinery, either alone or in combination with cotton, wool, hair, fur, silk, or shoddy, I take the fibre, after treating it by the processes just described, and divide it in proper lengths by some suitable instrument or machine. I then transfer the straw or fibre to a bath containing a strong solution of bicarbonate, sesquicarbonate, or even carbonate of soda, or any other similar compound; but the first two of these are to be preferred as most abounding in carbonic acid. In this bath I allow it to remain for about three or four hours, during which time the fibre becomes well saturated with the salt. I then immerse the materials impregnated with the solution of the carbonates before named, for about a couple of hours, in water acidulated by sulphuric acid, of about the strength of one

part of acid to two hundred parts of water. Or instead thereof, I expose the saturated materials while wet to the action of burning sulphur in a suitable chamber or stove.

In this operation it appears that a certain portion of gas being developed in the fibrous tubes, splits and divides them by its expansive power into filaments, having the character and appearance of fine cotton wool; in which state they may be dyed and manufactured like cotton or wool.

The same means of effecting the splitting of the fibre may of course be employed in the preparation of long fibre, and I do not limit myself to its use for the preparation of short fibre alone, but when the fibre is of its original length, the solution employed takes a longer time to penetrate the interior.

The decomposition of the bicarbonate of soda or other suitable compound, with which the fibre is saturated, may be also effected by means of electric agency, when a like evolution of gas and splitting up of the fibre will take place.

After the fibre has been subjected to the splitting process, it must be carefully washed to remove all soluble matters, and then dried.

The splitting process may be applied to the plant either in the straw (the wood of which is to be afterwards removed by proper means and machinery), or in the state of long fibre, whether prepared by my before described process, or by any of the usual and known processes.

Thirdly. My invention, in so far as it relates to improvements in yarns and felts, consists in composing the same of the following new combinations of materials. I manufacture a yarn which I call "flax-cotton yarn," composed partly of flax fibre, prepared and cut into short lengths, as aforesaid, and partly of cotton, varying the proportions at pleasure. This yarn is much stronger than yarn composed of cotton alone, and also much whiter and more glossy, while it is equally capable of being spun in the ordinary cotton-spinning machinery.

I also manufacture yarns, composed in like manner, partly of hemp fibre, or of jute, or of phormium tenax, or of other like vegetable fibre (China grass excepted), prepared and cut into short lengths, as aforesaid, and partly of cotton, which yarns each possess the same properties (more or less) as the flax-cotton yarn.

I manufacture also a yarn, which I call "flax-wool yarn," composed partly of flax prepared and cut into short lengths, as aforesaid, or of any other like vegetable fibre (cotton and China grass excepted); and partly of wool, or of that description of it called "shoddy," or partly of fur or hair, or partly of any two or more of the said materials; which yarn is stronger than any yarn composed of wool alone. Some wools also, which are too short to be spun by themselves, may, by being mixed with flax-fibre, cut into short lengths, form a material very suitable for spinning.

I manufacture also a yarn, composed partly of flax, or other like vegetable fibre (China grass excepted), prepared and cut into short lengths, as aforesaid, and partly of waste silk; that is, silk of the short lengths in which it exists before reeling, or silk rags cut into short lengths and carded.

Lastly. Flax felts, of a fineness and softness equal to the best felts, composed wholly of wool, and superior to them in point of durability, are also produced by a mixture of flax-fibre, prepared and cut into short lengths, as aforesaid, with wool, fur, hair, or any other feltable material.

And I declare that what I claim as secured to me by the said letters patent, is as follows:

First. I claim the method of bleaching by double decomposition, before described, whereby the various bleaching agents and compounds used may be recovered and economized.

Second. I claim the method of bleaching by the combined action of chlorides, or carbonates, or chromates, or any other bleaching agent, with fumes of sulphur, as before described.

Third. I claim the preparing of flax and hemp, and of all vegetable fibre capable of being spun or felted, from whatever descriptions of plants obtainable, by steeping the plant from which the fibre is derived, while in the state of straw, stem, leaf, or fibre, first in a solution of caustic, soda, or other solution of like properties, and then in a bath of dilute sulphuric, or other acid, as before exemplified and described.

Fourth. I claim the preparing of the said vegetable fibre for spinning in cotton and silk machinery, and for being combined with cotton, wool, raw silk, or other materials of sort staple, by firstly steeping the same in a solution of caustic, soda, or other solution of like properties. Secondly, steeping them in a bath of dilute sulphuric, or other suitable acid, or exposing them to the fumes of sulphur. Thirdly, saturating them with a solution of bicarbonate of soda, or any other like agent, and then decomposing such salt, however such decomposition may be effected; and, Fourthly, cutting them up into short lengths, all as before exemplified and described.

Fifth. I claim the employment generally in the preparation of flax, hemp, and other

sorts of vegetable fibre, of the mode of splitting by gaseous expansion, as before described, whether the fibre is long or short, and whatever may be the purpose to which the same is to be applied.

Sixth. I claim the manufacture of yarns and felts from a combination of flax, or like vegetable fibre (China grass excepted), prepared and mixed, as aforesaid, with cotton wool, "shoddy," silk waste, fur, and hair, all or any of them as before exemplified and described.

WEATHERLEY'S REGISTERED CURRANT-CLEANING MACHINE.

(Henry Weatherley, of 54, Theobald's-road, Confectioner, Proprietor.)

Fig. 1.

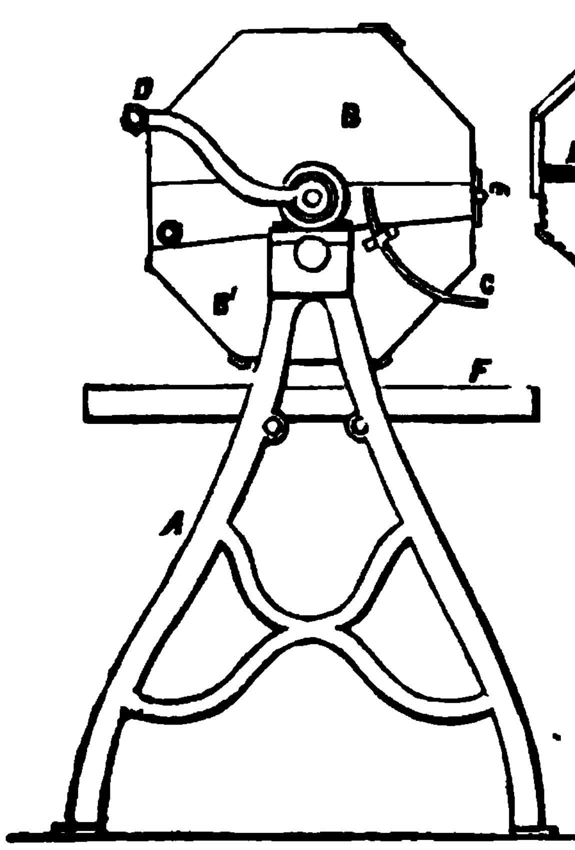


Fig. 3.

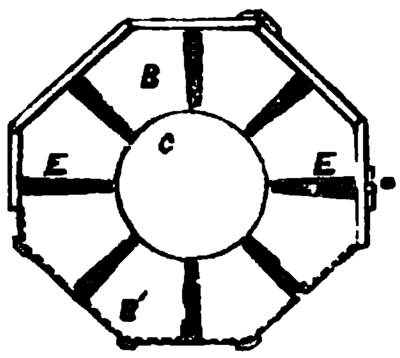


Fig. 2.

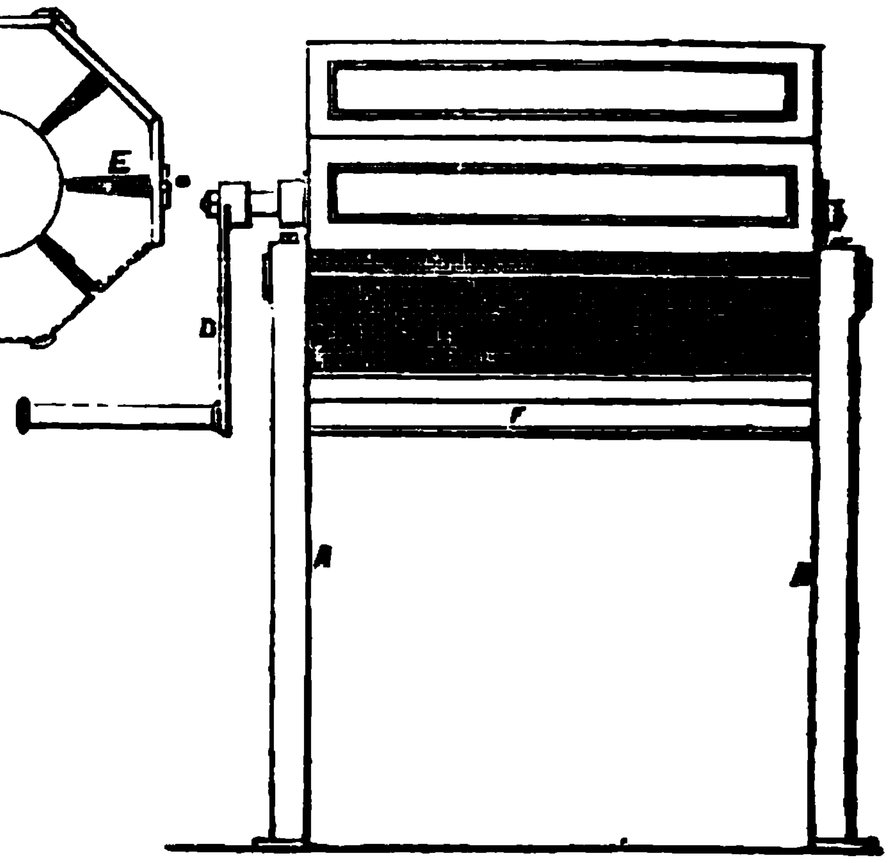


Fig. 1 is an end elevation, and fig. 2 a front elevation of this machine. A A is the frame; B B^1, a stationary case, the lower portion of which, B^1, is made of wire gauze of a mesh sufficiently small to prevent the currants passing through. The upper half of the case is hinged to the lower at *a*. C is a cylinder, a cross section of which, with the case is given in fig. 3; this is studded with bundles of split whalebones, E E, like a brush, and is made to rotate by means of the crank-handle D. F is a tray for receiving the stalks and other refuse which fall through the wire gauze; G is a quadrant which serves as a stop to the upper half of the case when folded back.

By the use of this machine the uncleanly practice of rubbing the currants with the hands over a sieve will in future be entirely superseded.

MR. RAWSON'S "SCREW-PROPELLER."*

Any work professing to add to the information we possess on the screw-propeller, must receive a very considerable share of attention from scientific and practical men; and that attention is very naturally increased if the reputed abilities and situation of the writer excite a reasonable expectation that our pains will not be bestowed in vain.

Mr. Rawson, whose work we now propose to notice, is favourably known as the writer of some papers in the "Transactions of the Manchester Literary and Philosophical Society," and his position in Portsmouth Dockyard, doubtless gives him access to important recorded experiments, and other documents bearing on this question, which are out of the reach of those less favoured. Everything, therefore, combines to engender the expectation that the "Screw-Propeller," coming from his hands, must be a valuable acquisition to the scientific world.

* "The Screw-Propeller: An Investigation of its Geometrical and Physical Properties, and its Application to the Propulsion of Vessels. By Robert Rawson, Head Master of the School for Shipwright Apprentices, Portsmouth Dockyard; Hon. Member of the Manchester Literary and Philosophical Society." London: by Whittaker and Co. 1851.

Nor has any book of late issued from the press with loftier pretensions to originality and practical utili'y; and its author commits it to the judgment of the public with no inconsiderable degree of confidence.

In his Preface he tells us, "But although the investigations are not so complete as I could have desired to make them, still I trust that the mathematician, naval architect, and engineer, will find in them *much that is new*, and at the same time capable of standing the test of *accurate mathematical examination.*"

To such a test we propose to bring his work, and we cannot think Mr. Rawson can have any right to be angry, if the result be to verify little more of his anticipations than such as relate to the novelty of his investigations.

We are far from desiring to discourage the efforts of any man, in extending the limits of scientific knowledge; but we must sacrifice every private feeling to the cause of truth; and as Mr. Rawson's name and situation are calculated of themselves to ensure a certain degree of currency to the notions supposed to be established in his book, we feel it the more incumbent on us to examine how far they are based on a solid foundation.

The first thing in the book before us which presents anything very striking is what the author calls the "Discovery of the Surface of Vanishing Pressure," in the second chapter. At the eleventh page we are told "If the screw-blade advance uniformly the length of its pitch, during the time it makes one revolution uniformly, the pressure of the water upon it can produce no effect to propel the vessel, because the edge of the screw-blade, in this case, is always presented to the water, which is cut by the edge of the blade, without its surface being pressed unequally by the water surrounding it." To this sentence, *put hypothetically*, we do not demur; all that we deny is that the vessel ever can move, for any appreciable length of time, under such circumstances; which will, we trust, be made apparent in the sequel. The author next proceeds to investigate an equation connecting the angular velocity of the screw, and its velocity in the direction of the axis when this takes place. We do not however perceive how the actual facts of the case are taken into consideration, unless we are to understand that the elimination of the element t (the time) between two equations be sufficient for the purpose. On the sixteenth page the author favours us with his application of this "surface of vanishing pressure" to explain certain anomalies which have puzzled practical men. We are told, "When the screw is working nearly on the surface of vanishing pressure, the motion of the vessel will be retarded until the screw is working at a greater distance from this surface, when the vessel will be accelerated. Hence there is a succession of alternate accelerations and retardations, until the resistance of the vessel and the power of the engine, through the medium of the screw, are in equilibrium, when there will be a uniform motion both in the vessel and the screw."

We shall here notice all that we gather to be the author's meaning on this subject, before we state our objections to this explanation. The remarks just quoted refer to the screw supposed working in still water: however, this is never the case. There is a current, we are told, following in the wake of the vessel, varying in velocity from that of the ship, at a point adjacent to it, to zero at a point at no great distance in the wake. The screw, therefore, must be regarded as working in water, which has a finite velocity in the direction of the vessel's motion, and, in consequence, the resistance on the blade will sooner vanish than if it were working in still water. But with this necessary caution the observations made on the case of a screw working in still water apply to all cases. We are therefore to conclude that the following expresses the author's views on this point. Having quoted the *supposed* observation of this phenomenon in the *Fairy*, by a writer in the *Practical Mechanics' Magazine*, where the writer says that the screw appeared to slip and hold *alternately*, and does not give any opinion of its *mean* speed compared with the speed of the ship: he says, "This fact is accounted for by such a relation subsisting between the velocity of the vessel and the rotation of the screw as is required for the screw to work on its surface of vanishing pressure. This being the case, the speed of the vessel must diminish, *although the angular motion of the screw be the same*, until the screw is working at a distance from the surface of vanishing pressure, and then the motion of the vessel must be increased," &c., &c.

That the vessel would be retarded if the screw were to work on its surface of vanishing pressure we do not deny; but how is it to get into this position, except in certain cases, for an instant? We cannot accept the above quotation as a satisfactory explanation of a singular fact, such as that suggested by the "Plumper," where the motion was not watched an instant only, but was the result of a trial occupying some hours, while trying her speed over the measured mile in Stokes' Bay. There may have been

many such phenomena as those recorded in the *Fairy* during that time, and for several instants the screw may have been on the surface of vanishing pressure.

What really must take place with every vessel propelled by a screw? It will attain its state of uniform motion within a few moments of its being started. Before this takes place, the power of the engine exerted through the screw is greater than the resistance of the water to the vessel's motion; this excess accumulates in the vessel in the form of *vis viva*: but as the speed of the vessel increases, this resistance increases, and increases very rapidly—in fact, as the square of the velocity of the vessel. Supposing, then, the force applied by the engine to remain the same, the excess of the latter above the former rapidly diminishes until it becomes zero, when the vessel will move uniformly until the power of the engine be altered, or some other circumstance be changed.

Now if the screw were working on its surface of vanishing pressure, it could exert no effect in propelling the vessel, because the pressure of the water on the screw would be zero.

What, then, would be the astounding fact? Why, we should have the vessel moving with a very considerable velocity, and therefore calling into play a very considerable resistance of the water against its bows to impede its motion; and as the screw is working on or near its surface of vanishing pressure, little or nothing to counterbalance this resistance!!!

Moreover, the moment this resistance becomes greater than the force exerted through the screw, there must be *vis viva* generated in the vessel in the direction opposite to its motion, and therefore the vessel must be at once retarded. But this cannot be the case, unless some force additional to that of the engine has been applied to the vessel, so as to *enable* the resistance to become greater than this force. The author cannot suppose that the velocity of the current in the wake of the vessel can effect this; for he tells us himself that the velocity of this current never *exceeds* that of the vessel, and therefore it can never produce a pressure *greater* than that on the vessel at *rest*, and, of course, totally inadequate to overcome the great resistance on the vessel's bows.

Besides, in this alternation of acceleration and retardation, which the author describes, which can only take place by the force of the engine being sometimes *greater* and sometimes *less* than the resistance of the water, there must be some intermediate position where the two forces are equal. Why, then, does not the vessel, when it comes into this position, move (as the first law of motion requires it) uniformly with the velocity it then has? Unless the force of the engine be subject to great and sudden variations, or the water suddenly yield to the pressure, and giving way, produces a result somewhat similar to the *skidding* of a locomotive on rails—a circumstance not unlikely to take place in vessels of light draught, when the screw works in shallow water, and is, we believe, what was actually observed by "Go-a-head" in the *Fairy*; except in such case, the circumstances which Mr. Rawson describes never can take place. Another objection also strikes us. Not only does the screw exert no force to overcome the resistance of the water against the vessel's bows, which is thus unbalanced if it works on its surface of vanishing pressure; but, besides, the whole force of the engine must be expended in overcoming its own friction and that of the screw. Hence the useful load being zero, and the supply of steam being still kept up as before, the pressure on the piston must be very much diminished, and therefore the velocity enormously increased. But the author himself tells us (we have put his words in italics) that the angular motion of the screw is *to be the same* all this time. We may, then, certainly conclude that Mr. Rawson's attempt to account for the phenomenon of a negative slip—that is of the mean speed of a vessel during a considerable time being greater than that of the screw, by means of the surface of vanishing pressure—is a failure, as he gives no reason which pretends to be founded on *physical* causes; and as we have seen, every mechanical consideration is completely against him. Moreover the discovery of this surface can be a matter of no practical moment; for if, under the circumstances we have above supposed, as in the case of the *Fairy*, the water should yield and exert no pressure on the screw, this could take place only for an inappreciably short space of time—and though it might happen several times in the course of an hour, it could produce no appreciable effect on the mean speed of either the vessel or the screw. The real explanation of this phenomenon, therefore, which we do not think it our own province here to supply, must be sought for in something more satisfactory than the surface of "vanishing pressure."

In the sixth Problem, page 20, we may remark that we are unable to distinguish between the *angular* velocity of a point on the helix at a distance unity, from that of a point at any other distance from the axis; we presume the author meant to put $x\,w =$ the *linear* (not angular) velocity of every

point in Bg. We should have passed this over as a mere clerical error, but that similar confusions between linear and angular velocity, between accelerating and moving forces, &c., are continually occurring—Ex. Page 59, last line; and page 61, 17th line.

It is now time to notice an error of a more serious kind, which Mr. Rawson has introduced into his fundamental equations, which runs through and vitiates all his speculations on the screw as a propelling power. In the seventh Problem, page 21, he proposes to find the forces acting upon the screw-blade, when the vessel is at rest, and the screw moving with an angular velocity w. Calling P the moment of the engine applied to the screw he puts

$$\frac{P}{2\,A'TK}$$

where A' is the area, T the thickness, and K the radius of gyration of the screw-blade for the (angular) accelerating force of P on the screw. This supposes the density of the screw to be unity; we should prefer for this term

$$\frac{Pg}{2A'TWK},$$

where W is the weight of a cubic foot of the material of which the screw is made, and g the force of gravity. He then proposes to estimate the effect of the resistance of the water. For this purpose he assumes $nf(V)$ to express the accelerating force of the resistance perpendicular to the blade of the screw, where n is a constant to be determined by experiment. He then resolves this force into two, one parallel and the other perpendicular to the axis of the screw. The former of these, $nf(V)$ cos. θ, he tells us is expended by pressing on the blade of the screw, and *if the vessel were* at liberty to move, this force would move it. The other force, $nf(V)$ sin. θ, resists the motion of rotation at any point x distance from the axis.

Then substituting for sin. θ the value he has obtained in terms of x, multiplying by the length of the helix at distance x, and integrating between the limits $x=0$, and $x=r$ for the whole screw-blade, he obtains the expression,

$$2\,nh\int_0^r f(V)x dx,$$

which he calls the moment of the accelerating force of resistance on both blades of the screw, and subtracting this from the expression

$$\frac{P}{2\,A'TK^2},$$

he puts

$$\frac{P}{2\,A'TK^2}-2\,nh\int_0^r f(V)x dx$$

for the accelerating force, to produce angular motion on the screw. Now here we join issue with Mr. Rawson. In the first place, as he addresses himself especially to practical men, we would ask him, in assuming $nf(V)$ to be the *accelerating* force of resistance, how he proposes that n should be determined by experiment? The *accelerating* force of resistance must depend on the mass of the body moved—in this case the screw; and hence n must be different for every different screw—not very convenient, therefore, otherwise as a measure of force. Had he taken the pressure against an element of the screw-blade it would have been dependent only on the density, &c., of the water, and the velocity of the screw-blade, and would have given a measure of force at once falling within the range of experiment, and independent of the mass of the screw set in motion or retarded by it. Again; if $nf(V)$ be an accelerating force in the usual acceptation of that term (and if it be not, Mr. Rawson ought to have furnished us with a definition of it), it stands for a certain number of feet; and such we presume to be our author's supposition, because he tells us that the resolved part of this, in the direction of the axis, would move the vessel, if free to move, and is a measure of twice the number of feet through which the vessel would in consequence move (supposing no other force to act upon it) in the first second of its motion.

On this supposition

$$2nh\int_0^r f(V)\,x dx$$

being obtained, 1st, by multiplying the resolved part of $nf(V)$ perpendicular to the axis of the screw by x, the distance of a point in the helix from the axis; 2ndly, by multiplying by the length of the helix whose distance is x; and 3rdly, by integrating between the limits $x=o$ and $x=r$, a summing up of these terms for the whole screw blade must be of *four* dimensions, comparable therefore to a *moving force*.

Now $$\frac{P}{2A'TK}$$

is of no dimensions, as it ought to be, being the first term in an expression for an angular accelerating force, *i. e.*, the angle (in circular measure), added to the motion in a second of time by the force (supposed constant.)

Hence in assuming

$$\frac{P}{2A'TK^2}-2nh\int_0^r f(V)\,x dx$$

to represent the whole accelerating force to produce angular motion in the screw, Mr. Rawson subtracts from a quantity of 0 dimensions one of 4; or from a ratio a moving force!!! that is from a simple number, a number of pounds!!!

This, surely, is no insignificant error.

The same error is committed (*mutatis mutandis*) in the 8th Problem, which differs from the preceding only in the supposition that the vessel is moving with a velocity v, and therefore we require $V-v$ in place of V.

Now it may be answered that we misunderstand the author in his assumption of the constant n, and that, if properly understood, the term

$$2\, nh\int_0^r f(V)\, xdx$$

will be of no dimensions. To this we reply, that if the author does not mean $nf(V)$ to be an *accelerating force* in the sense mathematicians understand that term, then it was incumbent on him to explain what it does represent. We are at a loss to find a name for it, since when, increased by three dimensions, it is a term of no dimensions. But let us see how this is reconcilable with the mode the author has treated it in other places. We have already observed that he tells us that the resolved part of $nf(V)$ in the direction of the axis of the screw would move the vessel if free, thereby making it *really* an accelerating force. Now let us see how he treats it in Prob. 8. The accelerating force resisting the motion of the vessel is taken to be $mA''vx$, and then we are told

$$2\beta n\int_0^r f(V-V')\, xdx - mA''v^2$$

represents the *accelerating force* of both blades of the screw to produce motion in the vessel. On this supposition, each of these terms ought to represent a certain number of feet; but if $nf(V-V)$ is an accelerating force in the sense understood amongst mathematicians,

$$2n\ \beta\int_0^r f(V-V)\, xdx$$

being the summation of the resolved parts of forces of this form for the whole surface of the blades of the screw must be of three dimensions. Hence we have the anomaly of the accelerating force on the vessel being partly of one and partly of three dimensions!!! Assuming, for the sake of argument, that

$$2n\beta\int_0^r f(V-V)\, xdx$$

is only of one dimension, then is

$$2nh\int_0^r f(V-V)\, xdx,$$

which is a term in the angular accelerating force on the screw, of two dimensions, whereas it ought to be of none. Now all the results to the end of the 15th Problem are obtained by combining these two expressions, namely, that for the angular accelerating force on the screw, and that for the linear accelerating force on the vessel, in which, according as you please to take it, the former has a term of 4, and the latter of 3, or the former of 2, and the latter of 1 dimension!!!

We will notice here, as germane to this portion of our remarks, another of those very confused uses of mathematical terms which we have had occasion to speak of as characterizing our author's investigations. —On page 62, Problem XI., he says:— "Adopting the same notation as in the last problem, we shall have $nF(V_1)\, dm$ = the accelerating force in the direction of the normal, where dm represents the element of the screw blade at a point whose rectangular co-ordinates are x, y, z, and n is a constant quantity." The first case certainly we have ever met with in which an accelerating force had the element on which it acted for a factor! We cannot be surprised if equations obtained with so notable a disregard of first mechanical principles, lead the author to results of a sufficiently startling and novel character. For example, on page 24, he gives this expression:—

$$v^2 = \frac{2\,P\,\mathrm{Cot}\,A}{mA''Thr^4\left\{\left(1+\frac{\mathrm{Tan}^2 A}{2}\right)\ \mathrm{cosec}\ A - \frac{\mathrm{Tan}^3 A}{3}\log\left(\frac{\mathrm{Cot}\,A}{2}\right)\right\}}$$

The numerator being the moment of a moving force is of five dimensions. Also since $mA''v^2$ is an accelerating force, and therefore of one dimension, and A'' and v^2 are each of two, it follows that m is of -3 dimensions, and it follows at once that $mA''Thr^4$ is of five dimensions; hence v^2, the square of a velocity, is of no dimension!!! From the same expression the following practical result is obtained:— That the angle of the screw remaining constant, the speed of the vessel is *increased* by *diminishing* the length and diameter of the screw. As far as this expression goes, what is to prevent the diameter or length of the screw vanishing?—when we shall have this remarkable result—that the vessel will move faster without a screw than with it.

How will practical engineers receive these (theoretical) facts?

Again, page 25, we have these results:—

$$\left.\begin{aligned} v &= \frac{ah}{b} \times \frac{p-s}{2\pi h - \beta(p-s)} \\ w &= \frac{ah}{b} \times \frac{2\pi}{2\pi h - \beta(p-s)} \end{aligned}\right\}\dots\dots\dots\dots(2)$$

where v is the velocity of the vessel, a the angular velocity of the screw, h the length, p the pitch, and s the slip (as the author defines it.)* The author infers from these expressions that the velocity of the vessel is a maximum if the denominator of the fraction expressing it $=0$, which gives $f=0$. But the same equality gives w and v each *infinite*. How does the author reconcile this with his statement at the top of the 11th page?—"If the screw blade have an infinite angular velocity, the pressure of the water upon it can produce no effect to drive the vessel on." How, then, is the velocity of the vessel to be infinite under such circumstances, being *retarded only* by the resistance of the water on its bows?

In the 12th Problem, the author introduces us to another specimen of his original mode of mechanical reasoning. He is endeavouring to introduce a correction for the friction developed. He accordingly tells us that M. Morin has established the law that friction of motion is wholly independent o the velocity of motion.

"Assuming, then," says he, "the above law, we shall have as follows:—

Put $f=$ moment of friction when the velocity is unity.

$\therefore fw=$ moment of friction when velocity is w.

"*For by Morin's law f is constant for all velocities.*

"Hence this moment of friction must be deducted from P in the foregoing equations." This is, without exception, the strangest reasoning, proceeding from a professed mathematician, we have ever had the luck to encounter. Because experiments establish the law that friction is independent of velocity, *therefore* we must multiply friction by the velocity to obtain its true value!

Does our author know what the co-efficient of friction means? Were he computing the *amount* of friction, developed in the form of *work*, then w might enter as one element in determining the path described by the point of application of the friction; but to subtract fw from P, the *moment* of the engine is quite a different thing. We shall not waste time by commenting on the results which are thus obtained, which must, of course, be utterly wrong.

We may observe, however, that one of these marked (7) shows that the angle of the screw being constant, the slip varies between p and $p-r$ tan. A, what becomes of the zero and the negative slip, then, and all the anomalies which the surface of vanishing pressure accounts for?

Prob. XV. gives us again the velocity of the ship

$$V=\frac{\text{cot. A}}{r}+$$

other terms, that is the velocity, is of -1 dimensions. A strange result truly!

We now purpose to bring before our readers another class of the author's investigations. We find in the Notes on Chapter II. that, after repeating his former erroneous investigations for the *accelerating* force on the screw and vessel, the author goes on thus, "Put R to represent the force in pounds avoirdupois, which is necessary to prevent the action of the screw-blades on

* After giving this definition, our author proceeds:—"When the vessel advances a distance greater than the pitch of the screw, the vessel is said to move faster than the screw. With these conventions I have nothing to do but explain them as they are used and known by practical men; but I cannot refrain from thinking they are unhappily selected to explain the phenomena of the action of the screw on the water to propel the vessel along."

Now on this we have to observe, that the author has not dealt quite fairly by practical men in leaving the definition of slip as we have quoted. For, although it is true that if, for example, the screw is moving faster than the ship by three knots, practical men would say there was a slip of three knots per hour, yet they never leave it in this state, but immediately compare this with the velocity of the screw, and obtain what they call the per centage of the slip, *i. e.*, the loss of velocity per cent. of the screw. Now if the slip is three knots, and the velocity of the screw twelve knots per hour, they would say the vessel had a slip of 25 per cent. Now this, we think, is important to observe; for if, with another engine or screw, the per centage were 15 per cent., they would conclude the latter circumstance more favourable for working with the screw by 10 per cent.—*i. e.*, that they were obtaining so much more per cent. useful work out of the engine.

Now the object of practical men is, not to explain the action of the screw on the water to propel the vessel along, but to establish a conventional mode of comparing the losses of power of different engines as applied through the screw, or shown by the difference of the rate of the screw and the vessel: and surely no one can deny that this is a most important practical object, and that it would be difficult to find a mode of effecting it more direct, satisfactory, and easy of application than that which practical men have long adopted. We think, therefore, Mr. Rawson's sneer at practical men is neither formed in common sense nor justice.

the water from moving the vessel to which the screw is attached when the engine is turning the screw with a uniform angular velocity w; then R will be the measure of the *accelerating force* of both blades of the screw in the direction of the axis of the screw; therefore we have from equation (3)

$$R=2\beta n\int_0^r f(V)xdx."$$

We had always supposed that pounds avoirdupois were of the nature of moving, not accelerating, force, when they produce motion! The author then obtains this equation:

$$P=\frac{I\rho R}{\pi}\ldots\ldots\ldots(7),$$

where I is the moment of inertia of both blades of the screw, on which he thus comments, "From this singular and important equation, we may readily obtain the useful moment of the engine used to turn the screw-propeller round by observing the values of R from experiment, and calculating the moment of inertia of the screw-blade."

Now, had the correct formulæ been used, we should have obtained this result

$$P=\frac{pR}{2\pi},$$

or $2\pi P=\rho R$, which the reader will easily see is nothing more than the equation of virtual velocities, whence we conclude, "From this neither singular nor new, but still important equation, we may conclude that, as in other cases, so in that of an engine driving a screw-propeller, the equation of virtual velocities applies."

Equation (9)

$$\frac{P}{P'}=\frac{R}{R'}$$

is by great good luck right, because the author eliminates the sources of error! Indeed, the equation of virtual velocities immediately gives it.

Formula (7), viz.,

$$P=\frac{IpR}{\pi},$$

(which ought to be

$$P=\frac{pR}{2\pi},)$$

we are told supplies a practical method of obtaining the useful moment of an engine transmitted to the axis of a screw. The author then goes on to draw some very true, but not very original distinctions, between force applied directly and moment of force. But we are unable to see their applicability to the case in point. He reasons as though the force of an engine shown by the indicator were in its nature entirely distinct from the effective moment of the engine in turning the screw-blade round. He would find it very difficult, we believe, to establish this distinction.

The same screw being used on the same screw shaft, it will follow that the moment of the force required to drive the screw round at a given velocity must be the same whatever engine be employed. Will, then, the author admit that De Pambour's conception of the mechanical action of the steam-engine is correct? If so, the work developed by the steam in one stroke is equal to the work developed by the load on the piston in one stroke. Now the load on the piston is composed of the unloaded friction, the pressure of the uncondensed steam—the useful load, and the friction of the useful load. Now what is this useful load? Why it is evidently that force on the piston, which applied through the connecting-rod (if there be one) to the crank, is in equilibrium with the resistance to the motion of the screw.

Let P′ acting perpendicularly to the crank during the whole revolution, produce the same effect as the actual pressure on the piston does, and let r=*rad.* of crank.

Then $P'\times 2\pi r$=work done in one stroke, and if n be the n^o. of strokes $P'\times 2\pi n\nu$= work done per minute.

If p be the effective pressure of the steam on the piston.

And v' the velocity of the piston

$$P'\times 2\pi nr=pv'$$

and horse power

$$=\frac{pv'}{33000}$$

$$=\frac{P'\times 2\pi nr}{33000}$$

$$\text{but } P'\times 2\pi nr=P\times 2\pi n.$$

P being what our author calls the moment of force on the screw.

Hence horse power

$$\frac{pv'}{33000}\text{ or }\frac{P\times 2\pi n}{33000}.$$

The horse power being determined by the indicator, or by the effect on the screw,—whence it follows that, while this moment remains constant, the pressure itself, or the length of the crank being changed consistently with this condition, the horse power of the engine remains the same; and if the pressure remaining constant, the length of the crank vary, the horse power also obtained from the indicator will vary in the same proportion (supposing the velocity of the piston to remain unchanged.)

These considerations are sufficient to

show that our author's distinction between moment of force to turn the screw, and the pressure, as shown by the indicator, has no existence in fact; but that all engines which have the same horse power are equally effective in driving the screw, so far as moment of force is concerned. We do not mean, however, that all engines of the same horse power are equally convenient for driving screws.

One main object is to obtain a considerable velocity. Now, without altering the horse power, this is effected by diminishing the length of the stroke, which, however, will produce no effect on the horse power shown by the indicator. We will pursue this subject a little further, in order to establish evidently what we have already assumed to be the fact, namely, that

$$P=\frac{pR}{2\pi}$$

where P is the moment of the force of the engine to turn the screw, R the statical surface pressure—that is, the pressure in the direction of the axis of the screw, to resist the motion of the screw when the vessel is prevented moving (which is also evidently the measure of the pressure which would move the vessel if free to move), and p the pitch of the screw. The screw is supposed to have reached its state of uniform motion. We may, of course, conceive the pressure R applied at some one point of the screw blade.

Now while the screw makes one revolution, this point would evidently move in the direction of the axis of the screw (supposed moving through a solid body) through a length equal to the pitch. Hence the motion being uniform, and therefore the statical surface pressure remaining constant, pR is the work done by this pressure in retarding the motion of the screw in one revolution; but 2πP is the work done by the engine in the same time. Hence

$$2\pi P=pR, \text{ or } P=\frac{pR}{2\pi}.$$

Our author cannot, we believe, impugn this result, or the mode of obtaining it. How can it be consistent with his result—viz.,

$$P=\frac{IpR}{\pi},$$

when I is the moment of inertia of the screw blades? The remainder of this note, built upon false premises, as we have seen, we shall not further examine.

This note is further extended on page 42, note 4, where, from his usual equations, the author obtains the usual result, namely—

$$R\frac{1}{\pi}=\frac{\pi\Upsilon\pi}{pI} \qquad (5)$$

where $\Upsilon\pi$ is the number of units of work done by the engine at π,

$$R\frac{1}{\pi}$$

the corresponding *statical surface pressure* (Note 1.)

From these he obtains several expressions, none of which are right, as they involve the moment of inertia of the screw, one of which, viz.,

$$\frac{v''}{v'^2}=\frac{p'I'\Upsilon\pi}{p\ I'\Upsilon\pi'},$$

in which he compares the velocities of the same vessel with different screws, he brings to the test of experiment. It would not be difficult to prove that the formula

$$\frac{v''}{v'^2}=\frac{p'\Upsilon\pi}{p'\Upsilon\pi}$$

is strictly true.

Now in all the cases in which Mr. Rawson applies the formula, he makes an assumption which eliminates his error, namely $I=I'$, and reduces his formula to *ours*. We are not, therefore, surprised to find that theory and practice agree so admirably in these cases. But we deny that they afford any verification of his formula; for this he should have taken entirely different screws for which I and I′ were essentially different.

We must now notice the author's investigations on the vertical oscillations of vessels resulting from the action of the screw propeller.

Of course, his expression for the accelerating force in the direction of the radius, supposing a force to tend, as he says, to the centre, shares in the error which we have already so fully noticed. It is, however, with the reasoning of our author here that we are concerned. His remarks on the two-bladed screw (Smith's), on the 71st page, are (on the supposition of a radial force) correct enough. But when he comes to the three-bladed screw, his usual fatality follows him; and although now it is a mere question of resolution of forces, and not of accelerating and moving forces, the author seems determined to show how little dependence is to be placed on his investigations.

He tells us that in the case of the three-bladed screw, each blade being at an *equal* distance from the others, "There are three equal integrals, each of which may be called G, which represents the resultant of all the resolved forces in the direction of the diameter of the screw-blade, these equal forces act in directions which make an angle of

120° between each two, and pass through the same point." This we do not dispute; but what will the veriest tyro in mechanics say to his conclusion, "Hence their resultant is G $(\sqrt{3}-1)^2$." We are almost ashamed to prove that the resultant will, in this case, be *o*: for resolving two of the forces in the direction of the third, we obtain for this revolved part 2 G cos. 60° = G; and therefore the resultant = G − G = 0. And even those unacquainted with mathematical investigations will easily understand what we mean when we assert, in opposition to the author, that 3 equal forces tending to or from a point making equal angles about it must necessarily balance each other. All his remarks, therefore, on the oscillations produced by a three-bladed screw are erroneous. The author speaks of correcting the fault he imagined that he has discovered by making one of the blades a little longer. Did it not occur to him to ask *which* blade (all three being similarly placed and equal)? This, one would have thought, would set him thinking, and so discovering that he had made some grievous blunder.

The *Fairy* is, we understand, propelled by a three-bladed screw. What is the experience of the Dockyard officers with regard to the destructive effects upon her by these supposed oscillations?

Here we bid adieu to our author's errors, with the wish that we could have found cause to commend rather than to censure so much of his book. We have been surprised at the strange confusion of ideas on the first principles of dynamics, and of mechanics generally, which runs through this work; and recommend the author carefully to study some good elementary book, that he may give more definiteness to his ideas; and we predict that, should he take our advice, he will give to the world a very different second edition of the "Screw-Propeller:" and if he must then withdraw much that is original, he will have the satisfaction of reflecting that he has retained nothing but what is true, and given currency to no misconceptions. We, for our part, cannot understand the value of originality and novelty, unless conjoined with truth. To originality and truth combined we pay the most profound homage; but to originality without truth we cannot accord any very special merit, in a science especially where correctness is absolutely essential. We will, in conclusion, express our belief that the chapter in which the author investigates the strength of the screw, giving him no scope for his peculiar mode of treating mechanical questions, but plenty for his geometry, in which his attainments are not inconsiderable, is essentially correct.

We congratulate him also on the invention of the screw-compass, an instrument at once simple and effective, and which will save practical men much trouble, while it renders their conclusions correct; though here we believe the principle on which the instrument is founded has been long well known to engineers, the great merit of the invention lying in his pointing out the fact that, since 12 inches go to a foot, and 30° is the 12th part of 360°, therefore the height of the screw corresponding to 30° in inches is the pitch of the screw when expressed in feet.

Since writing the above we have observed a review of Mr. Rawson's book in the *Artisan* for the present month, February. We observe that, in that review, none of his *peculiar* results are the subject of comment.

That introduced, namely—

$$\frac{P}{P'}=\frac{R}{R'}$$

we have shown to be a consequence of the principle of virtual velocities; as also the fact stated to be proved—namely, that "Resistances to vessels are proportional to the moments of force exerted to put the vessel in motion."

We must also remark here upon the expression for the area of the screw, which we are told is particularly neat. On referring to the place where it is given in Mr. Rawson's book, we find this remark appended to it:—

"This formula, which expresses the area of the screw blade in terms of the length, radius, and angle of the screw, is more simple than the one given by Professor Main and Thos. Brown, Esq. (*see* 'Marine Steam Engine,' page 267.)" On referring to the "Marine Steam Engine," we expected to find some very complicated expression; it is, however, thus:—

$$\text{The surface of screw} = \frac{a^2\beta}{2}\left\{\text{Tan}^2\, \alpha \log_e \cot\frac{\alpha}{2} + \sec x\right)$$

where *a* is the radius, α the angle of the screw, and β the angle of the base of the helix (the same as in Mr. Rawson's book.)

Now $a\beta$ Tan $x = h$ the height of the screw; introducing this assumption, and remembering that

$$\frac{\sec x}{\text{Tan}\, x}=\text{cosec}\, x,$$

the expression becomes at once

$$\frac{ah}{2}\left(\text{Tan } x \log_{\varepsilon} \cot \frac{x}{2} + \text{cosec } x, \right)$$

exactly the same result as Mr. Rawson's; while we cannot help thinking that the mode of obtaining it in the "Marine Steam Engine" is the neater and more simple of the two. We find that we have already been forestalled in objecting to the reasoning employed in this book. And truly we are not surprised at this, where so wide a field is left for objections.

The writer of that review (we presume in the author's confidence) endeavours to meet the criticisms which it appears have been sent to the author.

His antagonists, we are told, urge that nf (V) should represent the *law* of resistance as a pressure, &c. The author has ventured to take another view: he supposes nf (V) to represent not the pressure, as above described, but the effect of pressure, called retarding force, or accelerating force when the sign is changed. In this case, we are told it is unnecessary to divide nf (V) by the mass moved to obtain accelerating force.

Now upon this we have little to add to the observations we have already made. We certainly anticipate more useful results from taking, as usual, a pressure than an accelerating force. But we do not think the objectors (if mathematicians) would have found so much fault as we are led to suppose, if the author had simply omitted to divide this term by the mass. But is this the case? The expression for angular accelerating force round a fixed axis is simply this—that it equals the moment of the forces (moving forces, of course) divided by the moment of inertia. And this latter is of the form MK^2, M being the mass, and K the radius of gyration. Supposing, then, nf (V) an accelerating force, it should be divided by K^2 before it is compared with

$$\frac{P}{2A'TK^2}$$

Has he done so? Instead of this, the author has summed up the *moment* of this force for every point in the surface of the screw blade, thus introducing two more dimensions, and has divided by nothing!!

It is admitted in the review that several objections are seen to the author's assumption on this point, while we are told that this assumption is a striking proof of the originality of the author's views.

This we do not dispute; but if the originality be such as we have shown it to be, long may our speculations be preserved from share or lot in it. We would rather have it said of our investigations—"true if not new," than "new, but not true," as we fear we must characterize Mr. Rawson's very *bold* investigations on the screw propeller.

ON PORISMS.—BY MR. T. T. WILKINSON, F.R.A.S.

The subject of porisms is one of those on which the most eminent geometers have held different opinions. Previously to the publication, in the *Philosophical Transactions*, of two of Euclid's Porisms as restored by Mr. Simson, the nature of these general propositions does not appear to have been clearly understood by any of the most eminent mathematicians, and it may indeed be questioned whether the whole knowledge of those who had paid most attention to the subject amounted to more than a few indistinct, though fortunate guesses. The publication of Dr. Simson's posthumous works tended materially to diffuse a more accurate perception of the nature of a porism, and accordingly several geometers of distinction in our own country attempted to elucidate this enigma of antiquity. Amongst these was that distinguished geometer, Mr. Reuben Burrow; but the following note found in his copy of Dr. Simson's "*Locis Planis*" will show how very imperfectly he had divined their real nature. From the terms of the note it would seem that Mr. Burrow had attempted to transform the enunciations of some of Dr. Simson's propositions on the Loci into Porisms, and had very pardonably fallen into the error of considering a porism as identical with a Local Theorem. Subsequent considerations, however, appear to have partially convinced him of his mistake, for he interlines a passage, at a later period, expressive of his dissent from "*Some*" of his former opinions. The authograph in the copy of the "*Locis Planis*" referred to bears date 1772, and the note was probably written shortly after the appearance of Dr. Simson's "*Opera Reliqua*," in 1776. He alludes to this valuable work in his *Diary* for 1777, and a more intimate acquaintance with its contents most probably led to the *corrective interpolation*.

Note by Mr. Burrow.

"On Porisms. If in the enunciations of the Propositions (which are now in the form of Theorems) the hypothesis was to remain as it is, and instead of saying 'the locus

will be such a line, &c.;' if it was required to determine what the locus would be:—then all this book (*Simson's Apollonius Locorum Planorum*) would be exactly in the form of Porisms, except the latter part of each proposition, which shows the composition or how to determine the Locus. For example, if Prop. VIII., had been in this form:—'if from a given point two right lines be drawn in the same right line, containing a given space, and one of them touch a right line given in position; required to show in what line the other point will always fall:'—this would be in the form of a Porism. In most of the problems in Apollonius de Locis Planis, in Theorems (altered as above), instead of 'right line and circle, &c.,' substitute 'Conic Section, &c.,' and see what would be the result of *such an inquiry*."

Shortly after meeting with the note, I transmitted it for the inspection of a valued friend, whose recent premature death is a calamity which all lovers of science must deeply deplore; and he, after comparing it with the Burrow MSS. in his possession, immediately decided that both the note and its correction had been written by Mr. Burrow, but it did not appear that he had ever attempted to apply his views to the Conic Sections. Professor Davies, however, did not suffer the matter to rest with his simple decision, but with characteristic liberality accompanied his remarks with some general observations on the Porism; and judging that they are not altogether unworthy of notice, I have drawn up this paper in the hope that they will prove as interesting to a portion of the readers of the *Mechanics' Magazine* as they have been instructive to myself.

Remarks on Mr. Burrow's Note, by the late Professor Davies.

"The proposed change in the *form* of the enunciation converts the proposition into a *Local Problem*—NOT INTO A PORISM. The very exception which he makes ought to have shown him that there was something defective in his proposed transformation. The truth is, that the great generality of Simson's definition of the Porism has created great difficulty in apprehending its meaning. If, for a moment, a mind like Burrow's could become confused on the subject, there must be a want of distinctness and appreciability in Simson's definition. I doubt, indeed, whether any Geometer ever acquired a distinct and complete idea of the Porism from Simson's definition of it:—just as I doubt *whether the Porism itself was originally discovered as an independent form of Proposition*. Yet it does happen that when the *full* idea is once gained, we feel that Simson's definition expresses it most completely and generally. We feel that we cannot improve it, make what change we will. Perhaps the following way of viewing it is as easy of appreciation as any. A point, line, or circle is to be constructed so as to fulfil certain assigned conditions dependent upon n data; that is, given n things to find a point, line, or circle, which shall fulfil some conditions with respect to them: then generally the problem is properly limited and capable of one, or sometimes two solutions. It may happen, however, that though these n data are, when taken arbitrarily, dependent each of all the rest; still, in particular selected cases, the nth datum may be actually some particular point, line, or circle, *which the system of* n-1 *data of itself contains*, when the constructive operations are performed. Thus the problem becomes indeterminate, *not from a general deficiency of data, but from a particular relation amongst the data being assigned*. The *statement that such relation can subsist* constitutes the Theorem of the Porism: the *method of finding this relation* constitutes the Problem. Leslie's method of giving the Problem from which the Porism originated, illustrates the principle very beautifully."

The easy style of these remarks will tend much to prevent any misapprehension of their meaning; but should the student wish for further information, I cannot do better than refer him to Playfair's instructive paper, "On the Origin and Investigation of Porisms," in the *Edin. Phil. Transactions*; or should this be inaccessible, to the valuable dissertation, "On the Ancient Geometrical Analysis," annexed to Mr. Potts's editions of "Euclid's Elements of Geometry."

Burnley, Lancashire, February 13, 1851.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING FEBRUARY 20, 1851.

CHARLES HEARD WILD, of St. Martin's-lane, civil engineer. *For improvements in certain structures for retaining water*. Patent dated August 17, 1850.

Claims.—1. Constructing graving-docks lined with plates of iron tied down to piles.

2. Constructing a floating-caisson dock with a wrought-iron cellular caisson, arranged and constructed so as to preserve its parallelism as it rises and falls with the water. This is effected by attaching to the

sides of the caisson shafts with toothed wheels, which take into racks let into the masonry, or by means of links.

3. Constructing dock walls and other similar structures of iron piles, with inverts of brickwork, masonry, or iron between them, the piles being kept in their places by ties.

4. Constructing the double gates of locks and similar structures for retaining water of iron plates arranged in a cellular form.

5. Constructing the gates of locks, and similar structures for retaining water, with an air-tight compartment at the bottom, admitting the water to flow freely in and out above, so as to preserve the balance of the gate, or nearly so, at any height of water.

6. A heel joint for the gates of locks, and other similar structures. Instead of making the heel of the gate perfectly cylindrical, a flat strip of wood, or other material, is dovetailed, or otherwise fastened to the gate, which, when the gate is closed, comes in contact with a corresponding flat piece let into the masonry.

William Keates, of Liverpool, merchant. *For improvements in machinery for manufacturing rollers and cylinders used for calico printing and other purposes.* Patent dated August 16, 1850.

Mr. Keates describes and claims :—

1. A compound machine for turning and boring cylinders and rollers of copper, brass, or any other suitable metal or combination of metals, for planing the inside, and for forming a longitudinal nib or projection in the interior of such cylinders and rollers at one operation.

2. A method of making hollow ingots cylinders and rollers, by casting the metal around a tube of equal or rather less diameter than the interior of the desired roller, which serves as a core, and forms the interior of such roller. The tube is to be filled with sand, or other suitable material, which can be removed when the casting has set. Also, a method of forming cylinders or rollers with a longitudinal nib or projection in the interior. A strip of metal is first bent round a mandril, so as to leave a space between its edges, the inner part of each of which is slightly champered off. A core, in which is a groove of equal width with the space between the edges of the partially-formed roller, is then introduced, and sufficient metal run into the mould thus formed to fill it. The exterior and interior of the roller are planed and finished in the usual manner.

Samuel John Pittar, of Church-lane, Clapham, civil engineer. *For certain improvements in umbrellas and parasols.* Patent dated August 13, 1850.

Claims 1.—The adaptation of a folding hinge or joint to steel or metal ribs of umbrellas and parasols.

2. The adaptation of telescopic tubular handles, composed of three or more lengths, to umbrellas and parasols with folding ribs.

3. Two constructions of hinge, each of which has a channel, formed to receive the rib, and a prolongation on both sides of the pin-joint to afford the means of securing one part of the rib to the hinge, and of supporting the other part of the rib vertically and laterally. Also, a method of securing the hinge to the rib by striking, pressing, or punching the hinge so as to cause it to lap around the rib.

4. A peculiar construction of catch, and its application to umbrellas and parasols of all descriptions.

5. A peculiar construction of runner catch, in which the runner is held by the catch below, and through or above it, and the application of this catch to umbrellas and parasols of all descriptions.

6. The employment of a ferrule screwed to the upper part of the handle for the purpose of securing and protecting the covering at the centre.

7. The employment of a sliding ferrule in umbrellas and parasols in general with tubular handles.

Alfred Holl, of Greenwich, Kent, engineer. *For improvements in steam engines.* Patent dated August 12, 1850.

These improvements consist mainly in forming the circumference of the piston curved or convex, so that it may have the capability of inclining from side to side in the cylinder, and thus constantly change the rubbing surface. Mr. Holl also proposes to cover in the space between the two cylinders, so as (whether the engine be condensing or high-pressure) always to keep the cylinders hot. The employment of this latter appendage is, however, optional, and it may be adapted to the cylinder of steam engines with pistons of the ordinary construction.

Claim.—The improvements in steam engines described.

William Croskill, of Beverley, York, civil engineer. *For improvements in mills for grinding, splitting, pulverizing and crushing bones, bark, ores, and other hard substances, and for grinding paint and other soft substances, and for shelling or removing the skin from rice, and other grain, and in machinery for giving rotary motion to mills, threshing machines, and any other machine requiring rotary motion to be communicated by any horse or other animal.* Patent dated August 6, 1850. No claims.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Edwin Ullmer, of the firm of Edwin and William Ullmer, of Fetter-lane, London, printing-press makers, for certain improvements in printing-presses. February 12; six months.

Charles William Tupper, of Oxford-terrace, Middlesex, gentleman, and Alphonse Rene le Mere de Normandy, of Dalston, in the same county, gentleman, for improvements in the manufacture of iron coated with other metal, commonly called galvanized iron. February 12; six months.

Charles Cowper, of 20, Southampton-buildings, Chancery-lane, for improvements in moulds for electro-metallurgy. February 17; six months.

Henry Francois Marie de Pons, of 24, Boulevart Poissonnière, Paris, France, gentleman, for improvements in constructing roads and ways, and pavements of streets, and the ballast of railways. February 17; six months.

Gustav Adolph Buchholz, of Norfolk-street, Strand, Middlesex, civil engineer, for improvements in motive power and in propulsion. February 17; six months.

David Ferdinand Masirata, of Golden-square, Regent-street, Middlesex, gentleman, for a new mechanical system with compressed air adapted to obtain a new moving power. Feb. 18; six months.

Thomas Dickason Rotch, of Furnival's-inn, gentleman, for improvements in centrifugal apparatus for separating fluid from other matters. February 18; six months

William Beadon, junior, of Taunton, Somerset, gentleman, for improvements applicable to the roofing of houses, buildings, and other structures. February 18; six months.

Hugh Lee Pattinson, of Scots-house, Gateshead, manufacturing chemist, for improvements in the manufacture of Pattinson's oxichloride of lead. February 18; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Feb. 13	2688	Wm. Richard Hodges..	Manchester	Iron stretcher for a traveller's bag, or portmanteau.
,,	2689	Edward Shingler	Birmingham	Wellington boot.
,,	2690	H. J. and D. Nicoll	Regent-street	Back, or waistband for trousers.
,,	2691	H. J. and D. Nicoll	Regent-street	Coat.
14	2692	John Langford	Birmingham	Handle for teapots and other vessels.
15	2693	J. D. Caulcher	Anstruther Villa, St. John's-wood	Cork jacket, or life-preserver.
17	2694	Clayton Shuttleworth and Co.	Stamp-End Works, Lincoln	Portable steam engine.
18	2695	Samuel Messenger	Birmingham	Burner for lamps.
19	2696	Henry Rradford and Matthew Frost	Primrose-hill, St. Brides	Amphaton, or doubly-perfected splatterdash.
,,	2697	Wm. Adolphus Biddell.	St. John's-square	Alarm door and window wedge.
,,	2698	John Hadley	Worcester	Sole to cover tires of carriage wheels.
19	2699	Joseph Welch and John Margetson	Cheapside	The unique braces.
,,	2700	John Morrison	Sheffield	Tap for high-service pressure.
,,	2701	Thomas Evans and Co.	Wood-street, Cheapside	The Queen's parasol.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Feb. 12	50	Stephen Geary	Euston-street, Euston-square.	Variegated lamp.
13	51	Thos. and Geo. Barnes	New-court, Goswell-street	The unique braces.
,,	52	Benjamin Browne	Belvedere-road, Lambeth	Shirt.
14	53	William Leuchars	Piccadilly	Double action lock.
,,	54	Chas. Henry Moysen	Bedford-street, Strand	New irrigator for making graduated and variable furrows.
,,	55	Geo. Gibbs	Bristol	Nipple-cover or protector, and hammer for percussion firearms.
15	56	Thornton and Killick	Ludgate-hill	Amphaton collar.
17	57	Thos. W. Tipler	Rugby	Portable fire-escape.
,,	58	David Stephens Brown	Alexandrian Lodge, Old Kent-road	Fumigating cover for bushes.
18	59	A. Boucher and Co	South-street, Finsbury	Castor.
,,	60	W. M. Bywater	Piccadilly	Water-meter.
19	61	Theodore Robert Brunell	Newman-street, Oxford-street	Photographic apparatus.

CONTENTS OF THIS NUMBER.

Description of Carnell and Hosking's Registered Treble Beat Hydraulic Valve—(*with engravings*) ... 141
Chevalier Claussen's Improvements in Bleaching and in the Preparation of Flax—The Specification ... 142
Weatherley's Registered Currant-cleaning Machine—(*with engravings*) ... 148
Rawson's "Screw Propeller, or Investigation of its Geometrical and Physical Properties, and its Application to the Propulsion of Vessels"—*review*) ... 148
On Porisms. By Mr. T. T. Wilkinson, F.R.A.S. 157
Specifications of English Patents Enrolled during the Week:—
Wild ... Docks ... 158
Keates ... Rollers ... 159
Pittar ... Umbrellas ... 159
Holl ... Steam Engines ... 159
Croskill ... Agricultural Machine ... 159
Weekly List of New English Patents ... 160
Weekly List of Designs for Articles of Utility Registered ... 160
Weekly List of Provisional Registrations ... 160

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1439.] SATURDAY, MARCH 1, 1851. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

MR. BEASLEY'S CHICORY-CUTTING MACHINE.

Fig. 1.

Fig. 2.

MR. BEASLEY'S CHICORY-CUTTING MACHINE.

(Registered under the Act for the Protection of Articles of Utility. John Beasley, Esq., B.A., of Spalding, Inventor and Proprietor.)

Description.

FIGURE 1 of the above engravings is a longitudinal section, and fig. 2 a plan, partly in section, of the registered parts of this machine. A A is a plate, which is formed in one piece with the hopper B, and fixed upon the general framework of the machine. C is a moveable bed-plate, which is free to slide to and fro upon the V-shaped grooves and rails D D, when acted upon by the connecting-rod E, which communicates motion to the moveable bed from a steam engine or some other prime mover. F is a knife, which is affixed by bolts to the ends of the moveable bed, and occupies a position immediately over the opening G. H H are two rows of knives or cutters, the upper ends of which are inserted in slots in the knife F, while their lower ends are fixed to the bed-plate C by means of the bars I I.

The materials to be cut are put into the hopper B, whence they fall by their own gravity upon the bed-plate C, when the movement of the knife F towards either side of the machine (by the action of the connecting rod E) causes the roots to be cut into slices horizontally, while the knives H H at the same time cut the horizontal slices crosswise, or in a vertical direction. K K are cross bars, against which the roots abut while being cut. The small cubes, thus separated, fall through the opening G into a receiver, or into a screen or riddle affixed to the bed-plate C.

The cutting of chicory, though possibly the use to which this machine is likely to be most extensively applied, is not the only one for which it is adapted, as it is obviously equally applicable to the division of roots of all descriptions.

MR. BILLS' EXTENSION OF HORNER'S METHOD.

Sir,—I beg to trouble you with a few remarks in reply to the observations of your correspondent "P. Q.," and "A ray of 'P. Q.'s' light" in reference to my "Extension" of "Horner's Method," published a few weeks back in your Magazine.

In the first place, the latter correspondent, "A ray of 'P. Q.'s' light," whom I take to be the veritable "P. Q." himself, and of whom I have an inkling, taunts me with not responding to the call of "P. Q." at page 494 of your last Volume. In reply to this, I have to observe—first, that I dislike to have any controversy with an *anonymous* correspondent; secondly, my daily engagements are of that nature that I find it impossible to spare time to work out my lengthened examples, and I thought that, probably, "P. Q." had more time to go through those calculations than I had; and, thirdly, I did not consider that "P. Q." was warranted in calling upon me to do what I had distinctly stated was no part of my design—namely, to separate the roots of equations, and to determine the initial values of those roots.

I have no hesitation in acknowledging that I am not prepared to discuss those points; but I may surely be pardoned for halting, when such men as Horner, Davis, Rutherford, and Weddle are unable to advance; and when even "A Ray of 'P. Q.'s' light," or, indeed, the whole round of rays emanating from the refulgent "P. Q." fails to illumine the path. I maintain, however, that those points are altogether irrelevant to the subject discussed in my paper; which I contend is a *legitimate* extension of Horner's method.

Horner's Method *assumes* an approximate initial value of the root to commence with, in case of the root being *real*, and then approximates to a more correct value; so, by analogy, in my extension to *unreal* roots, if $r \pm s\sqrt{-1}$ denote a pair of such roots, I suppose that we know by some means or other the initial values of r and s; and then I am prepared to show, that the process described in my paper will approximate to more correct values of r and s *at once* with the same efficiency that Horner's method does in the case of *real* roots.

"A ray of 'P. Q.'s' light" appears to have been too dull to discover my meaning, or he would never have made the assertion, that he had "tried my method over and over again," and it had always conducted him to *false results*.

I assert that I have tried it over and over again, and it has always, without *one failure*, conducted me *to true results*.

These assertions respecting the *legitimacy* of my extension, and the correctness of the results to which it leads, I have no hesitation to submit to the strictest scrutiny.

I think your correspondent was a little too hasty in denouncing my extension *in toto*, when in the preceding paragraph he had admitted that he did not understand my process.

Before proceeding to illustrate my method by an example, I wish to just advert to what the aforesaid "Ray" says respecting my alleged injustice to Dr. Rutherford.

Notwithstanding 'P. Q.'s' light is of that penetrating character that a single 'ray' of it could discover me poring over Dr. Rutherford's tract, it still failed to discover that my eyes were closed: as I most solemnly declare that I have *never* so much as *seen it*. From a slight allusion to it, however, which I have seen, I am quite satisfied that the discussions contained in it are of a character altogether different from the process described in my paper.

I am too sensible of the many obligations I am under to Dr. Rutherford to attempt to publish anything encroaching upon his researches.

Notwithstanding your correspondent thinks I acted injudiciously in publishing my paper, I can assure him that I did not do it without much deliberation, and I do not yet see any reason to be ashamed of having attached my name to it. I am quite aware that the determination of the initial figures in the case of unreal roots is more difficult than in the case of real roots: and it would be very acceptable if any of your correspondents could devise a more facile method of effecting this object; but *assuming* these initial values, or supposing them to be kown by some means or other, I have no hesitation in saying that my "Extension" places us in exactly the same position in reference to unreal roots, that Horner's Method does in reference to real ones, except that from the *form* of those roots the operation will necessarily be more tedious.

I had hoped that my paper would have been quite intelligible to your readers, but as it appears that some of them have mistaken my meaning, I will give an example in illustration of my method.

I am obliged to your correspondent for the esteem which he professes towards me, but I must say, that his regards would have appeared more *tender* if he had suspended his judgment until a "Ray" from some *brighter* luminary had discovered to him my true meaning.

Before giving an example, I would just lay down the following as the *principle* upon which my "Extension" is founded, and which I cannot yet see to be a "mistaken" one.

Suppose the equation—

$$x^n + ax^{n-1} + bx^{n-2} + \ldots + mx + n = 0,$$

in which the coefficients, a, b, &c. are finite; then it is well known, that in the case of the roots being *real*, Horner's Method is founded on the principle of rejecting all the terms except the last two, when x is very small, and taking $x = -\frac{n}{m}$ to a certain number of figures depending on the previously obtained value of x. In like manner my "Extension" exists on the principle of rejecting all the terms except the last two, when x is *unreal*, or of the form $u \pm v\sqrt{-1}$; u and v being very small; and taking $x = -\frac{n}{m}$, when m and n will generally be of the form $\pm p\sqrt{-1}$. Now in dividing one binomial surd by another, I am sure, Mr. Editor, I need not remark to you, that it is *indispensible* to first multiply both the divisor and dividend by the congeneric surd of the divisor, and then the quotient will be another binomial surd.

I cannot but say that I was astonished at your correspondent making the remark he did on this point.

I will now take the following example, in order to show the arrangement and mode of working, viz.:—

$$x^3 - 2x - 14x + 63 \cdot 9 = 0;$$

which equation has two unreal roots.

The initial values in this case are readily found to be

$$x=3{\cdot}2+2{\cdot}0\sqrt{-1}.$$

Assume, therefore, as directed in my paper,

$$x=y+3{\cdot}2+2{\cdot}0\sqrt{-1}.$$

Substituting this in the above equation, the result is

$$y^3+(7{\cdot}6+6\sqrt{-1})y^2+(-8{\cdot}08+30{\cdot}4\sqrt{-1})y+{\cdot}988-{\cdot}16\sqrt{-1}=0.$$

These imaginary binomial derivees I arrange as Horner does his simple real ones, as follows:—

A.	B.	C.
$+7{\cdot}6+6\sqrt{-1}$	$-8{\cdot}08+30{\cdot}4\sqrt{-1}$	$-{\cdot}988+{\cdot}16\sqrt{-1}$
${\cdot}01+{\cdot}02\sqrt{-1}$	$-{\cdot}0443+{\cdot}2124\sqrt{-1}$	$-{\cdot}693491+{\cdot}143638\sqrt{-1}$
$+7{\cdot}61+6{\cdot}02\sqrt{-1}$	$-8{\cdot}1243+30{\cdot}6124\sqrt{-1}$	$-{\cdot}294509+{\cdot}016362\sqrt{-1}$
${\cdot}02+{\cdot}04\sqrt{-1}$	$-{\cdot}0446+{\cdot}2128\sqrt{-1}$	$-{\cdot}2635915-{\cdot}0038206\sqrt{-1}$
${\cdot}002+{\cdot}008\sqrt{-1}$	$-{\cdot}03328+{\cdot}073192\sqrt{-1}$	
$+7{\cdot}632+6{\cdot}068\sqrt{-1}$	$-8{\cdot}20218+30{\cdot}898392\sqrt{-1}$	$-{\cdot}03009175+{\cdot}0201826\sqrt{-1}$
&c.	&c.	&c.

Roots.

$$3{\cdot}2+2{\cdot}0\sqrt{-1}$$

$${\cdot}01+{\cdot}02\sqrt{-1}$$

$${\cdot}002+{\cdot}008\sqrt{-1}$$

$${\cdot}000856+000770\sqrt{-1}$$

$$3{\cdot}212856+2{\cdot}028770\sqrt{-1}$$

In the above model the successive parts of the roots in the last column are the quotients arising from dividing the binomials opposite to them in the column C by the corresponding one in the column B. The binomials in the several columns are deduced exactly as in Horner's processes; and may be easily verified by any one acquainted with that method. The expression at the bottom of the column, headed "Roots," is the sum of the several parts of the root, and the root is correct to six places of decimals. I cannot think that your readers will require any further explanation. Another operation would give 10 or 11 decimals correct.

I am quite aware that the process is tedious; but what I insist upon is; first, that the method which I have described is a *legitimate* "Extension" of Horner's Method; and, secondly, that the results it furnishes are ***invariably and rigorously correct.***

I shall feel obliged, Sir, if you do me the favour to publish this reply. I should have sent it sooner, but I have been so fully engaged that I could not possibly get it ready until now, as those who know how I am situated will readily believe.

I remain, Sir, yours truly,

SAMUEL BILLS.

Hawton, near Newark-upon-Trent,
Feb. 17, 1851.

SEASONING WOOD ON A SMALL SCALE.

A correspondent of the *Gardener's Chronicle and Agricultural Gazette* having requested information of what apparatus a country carpenter might require to enable him to season wood on a *small* scale, a short paper on the subject appeared on the 15th inst. in that periodical, but as the readers of it are principally horticulturists and agriculturists, by a republication of the article in the *Mechanics' Magazine*, useful hints may be afforded to those very numerous persons who have occasion to employ wood in an unseasoned state, and the notion may be done away with, that it is only in great establishments that the requisite processes can be advantageously carried on.

It must be evident to mechanics that seasoning apparatuses might be considerably varied from those described without diminishing their efficiency, in order to adapt them to local situations and circumstances, and to the amount of duty expected from them. Sir Samuel Bentham's seasoning-house, No. 1282 of this Magazine, may, from its large dimensions—calculated to contain 3,000 loads of timber at once—have alarmed private persons, and so have checked the adoption of similar structures on a smaller scale; but the principles he laid down for the artificial seasoning of timber, are as applicable to small establishments as to those suitable for royal arsenals, and there can be no doubt but that timber-merchants generally would find it to their interests to season wood before selling it. Some persons may, indeed, have been deterred from attempting to season timber by warm air by a patent that has been taken of late years;* but no such patent could invalidate the rights of individuals generally to adopt modes that have been published by Sir Samuel from above twenty to forty years ago.

Within the last few days an extensive manufacturer of carriage-wheels by machinery has said that wood is always deteriorated by artificial seasoning: but that it is not so, when the operation is duly carried on, has been proved at Belper and at Birmingham. It is very true that when the seasoning has been *too rapid* the material has been injured; all of Sir Samuel's private experiments exhibited cracks and rents in wood, the outside of which had been dried before moisture of the interior had been entirely expelled. This cause of failure and deterioration is spoken of in the subjoined paper, as requiring to be particularly guarded against; and whoever may be induced to season wood by means of heated air should not fail to bear in mind Sir Samuel's official statement; namely, that success would depend on varying the heat given in a seasoning-house, according to the different kinds of wood, and state and stages of its seasoning—to the regulating at pleasure the admission of dry air to the seasoning-house—as also to the due emission of that charged with vapour.

In one respect it may, indeed, be said that wood is deteriorated by seasoning, whether naturally or artificially; for a well-seasoned piece, from its compactness, is *harder to work* than green or wet wood; consequently better tools and greater power are necessary in fashioning dry wood than wet—but work done to the wet is always coarse, and subject to be deformed in drying. A useful inference may be drawn from this: namely that in many cases it might be advantageous to cut up timber whilst wet, to nearly the form intended to be given it, and to season it in that approximative shape, but to leave the finishing to future operations, when it should have been made perfectly dry. At all events, Sir Samuel repeatedly insisted that no woodwork of any description should ever be *put together* till all its portions should, by seasoning, have shrunk to their smallest dimensions, in order that joints and junctions of every kind and form should remain permanently as perfect as when first turned out of hand.

Cowls turning with the wind to carry off water in a state of vapour have not hitherto been sufficiently appreciated and used. Some years ago the application of a cowl to a malt-kiln diminished the quantity of coal consumed by nearly a half.

M. S. B.

* The patent referred to (Messrs. Davison and Symington's) is for drying by *rapid* currents of warm air only.—Ed. M. M.

From the Gardeners' Chronicle and Agricultural Gazette.

"There seems no doubt but that the

desirable purpose of seasoning wood on a small scale might be effected either by means of warm air, as practised long ago by the Messrs. Strutt, at Belper, or by means of a steaming apparatus, where there may be already one for other purposes. If by warm air, as at Belper, there would be required an air-heating chamber, and a seasoning chamber above it. The air-chamber need only be large enough to receive a stove, and to afford space for attendance upon it. Into this chamber, air should be admitted through *two* pipes, each of them large enough to allow passage for the requisite quantity of air for seasoning the wood, as well as to supply the fire; these pipes should pass to the exterior at *opposite* points of the compass, since it has been found that when air is admitted on only one side of a building, heated air from within, passes out when the wind is in the opposite direction. These pipes should be furnished with slides or valves, so that the one opposite to the wind might be closed at pleasure. Such slides or valves might be made self-acting, by connecting them with a vane; but where cheapness of the apparatus is an object of importance, the entrance of air might be sufficiently well regulated by hand. Above the air-heating chamber should be that for the reception of wood to be seasoned, and having communication with the hot-air chamber for the passage upwards of heated air. It would be desirable, if easily practicable, that spaces should be left for the air between the several flooring boards, so as to promote a general diffusion of it; but this is not essential. The seasoning chamber should, of course, be large enough to contain the whole quantity of wood it might be wished to season at one time; the boards, quartering, deals, &c., should be arranged *perpendicularly* in the chamber, and so that no one piece should touch another, excepting at the point of support, thus leaving a passage for air between each of the several pieces. An exit for air charged with moisture should be provided at the part of the chamber most distant from the entrance of the heated air from below. This exit aperture, formed as a chimney of some height, should be surmounted by a cowl, turning with the wind to favour the exit of heated air charged with water. In this way planks were seasoned at Belper in three weeks, and thin stuff in a much shorter time.

"It is evident that the seasoning chamber need not necessarily be immediately above the heating chamber, since hot air might be conveyed from the latter by means of well-jacketed pipes through several stories; some little experience would be requisite in the use of even this simple apparatus—a carpenter does not make a straight cut at the first attempt. The error most to be guarded against, is that of proceeding too rapidly in the drying process, since thereby cracking and splitting of the wood might be expected, or that the interior of it might not be perfectly seasoned, though the outside were so. The great desideratum in seasoning wood is, that the external parts should be kept open till all moisture from the interior has been evaporated. The exact heat kept up at Belper in the drying chamber is not recollected, but, to the feeling, it did not exceed the temperature of a warm summer day. The degree of heat would, however, require to be a little varied according to the kind of wood to be seasoned, and to its different states during the process of dessication. A few pounds would pay the expense of the whole apparatus.

"Seasoning by steam would be more costly on a small scale, excepting where a proper boiler was in use for other purposes; but in the latter case, the only additional expense to be incurred would be that of a receptacle for the wood to be seasoned, a pipe connecting this receptacle with the boiler, a tap for turning on or off steam, and a chimney with its cowl, and closeable at pleasure. The usual attendant on the steam apparatus for other purposes would be competent to the turning steam on or off from the seasoning chamber. In this mode no injury to the wood need be apprehended from frequent interruptions of the dessicating process,—since the seasoning chamber being filled with vapour, the external parts of the wood within it, would be kept moist and open, supposing only that exit of the vapour were prevented by shutting up the chimney. It need scarcely be added, that a longer time would be requisite for seasoning wood where interruptions of the steam should have place, and that more or less according to their length and frequency."

ON THE FORM OF THE INTERIOR OF BLAST FURNACES, AND ON THE DESCENT OF THEIR CHARGES. BY SIR F. C. KNOWLES, BART.

Sir,—In the *Mining Journal* (Nos. 804 and 806) will be found two papers, one "On the Condition of Heat in Blast Furnaces;" the other with the above title, and a reference to this article for more detailed information. In the first of these it was proved, on the authority of the Report of Playfair and Bunsen (British Association, Cambridge, 1836), "On the Gases evolved from Blast Furnaces," that all the heat of the furnace above the tuyeres is heat produced by *conduction from below*, and not by the

combustion of fuel above; for if, as the Report states, it is true that the oxygen of the blast is at once taken up in carbonic oxide, there *can be* no free oxygen, no *support of combustion above*. This conclusion, the importance of which is in all respects very great, reduces the phenomena of the blast furnace (if raw limestone be excluded, and quick lime only used as flux), to a combination so much more simple, as almost to invite the application of exact science to an analysis of them.

In order to bring the phenomena within this domain, we shall make a supposition which is anything but correct, viz., that the contents of the furnace are fluid—(*imperfectly* fluid, *viscous*, if you will,) and that they are *uniformly* removed below by an action having all the effects of a pump. We shall thus, of course, commit an error; for the materials are not even so nearly fluid as sand; but, though our hypothesis be incorrect, yet we may arrive by means of it, at a close approximation to the law which really obtains; and if we correct our result *by the introduction of a constant, determined by the comparison of our formula with facts, by observation of the actual working of furnaces*, the deviation from fluidity, with its effects, which will be of constant action on the average, will be expressed in our final result, and the errors due to the original and faulty hypothesis will be eliminated, and a tolerably approximate *empirical* formula will be obtained.

This premised, as the consumption of fuel is *uniform* (blast, and fuel, &c., *given*,) and produces the descent of the charges, we must first compute what is its amount, from the ordinary data of the nature of the fact, the blast, the oxygen thrown in, and its combustion of the carbon into carbonic oxide. Let then v be the velocity of the air at the nozzles of the blast pipes nm^2 the area of their orifices, n being their $n°$, then is nm^2v the cubical quantity injected; and if $1+\delta$ be its density (that of atmospheric air externally being 1), and q the weight of a cubic foot of air at the atmospheric pressure and temperature* $q(1+\delta)nm^2v$ is the weight of that air, and

$$\frac{q(1+\delta)nm^2v}{5}$$

is about the weight of its oxygen.

The weight of carbon with which this combines in order to form carbonic oxide (with which the Report above referred to states to be the product), will be

$$\frac{6}{8}\times\frac{q(1+\delta)nm^2v}{5}$$

or,

$$\frac{3q(1+\delta)nm^2v}{20},$$

and if $1+\theta : 1$ be the ratio of the weight of the fuel to that of its carbon, the weight of the fuel consumed in one minute of time will be

$$\frac{3q(1+\delta)(1+\theta)nm^2v}{20}$$

At any point let M^2 be the section of the interior of the furnace considered as a solid of revolution; V the velocity with which the materials pass through that section; then if c be the weight of a cubic foot of the fuel, cM^2V will nearly represent the weight which passes through M^2 in one minute of time. Now, the essential condition is that this shall be equal to the fuel consumed below (for the mass is supposed to be *continuous*) that is

$$cM^2V=\frac{3}{20}.\ q(1+\delta)(1+\theta)nm^2v,$$

or, if y be the ordinate of the profile of the section, and r the radius of the nozzle $M^2=\pi y^2$ and $m^2=\pi y^2$ $\therefore$

$$cy^2V=\frac{3}{20}\times q(1+\delta)(1+\theta)nr^2v$$

but

$$V=\frac{dx}{dt},$$

if the abscissa be vertical,

$$\therefore\ \frac{dx}{dt}=\frac{3}{20}\frac{q(1+\delta)(1+\theta)nr^2v}{cy^2}\ (1).$$

The nature of the curve, which forms the internal section, gives the relation between x and y, and, this being known, t is found by integration.

The simplest form is that in common use, a truncated cone, of which the "boshes" are at the base: this is adapted to another truncated cone reversed towards the tuyeres, and terminated by the top of the crucible. The whole time of descent is the time to the

* The corrections for these are easily added, if required.

boshes added to the time to the top of the crucible.*

If we make the axis of the furnace that of x; a the height of the vertex of the cone above the origin of x and the throat, and b the semi-diameter of the throat

$$y = \frac{b}{a}(a+x),$$

$\therefore$ by substitution for y in (1)

$$dt = \frac{20\,cb^2(a+x)^2 dx}{3\,q\,(1+\delta)\,(1+\theta)\,a^2 nr^2 v}$$

and, integrating,

$$t = \frac{20\,cb^2}{3\,q\,(1+\delta)\,(1+\theta)\,a^2 nr^2 v} \times \frac{(a+x)^3}{3} + \mathrm{C}.$$

$$= k\,(a+x)^3 + \mathrm{C}.$$

putting k for the general co-efficient. If we wish to include the effect of the changes of ore, we may safely assume the space they occupy as proportional to y^2. This comes to putting $(1-0)y^2$ for y^2, which will introduce $1-0$ (0, a small fraction) into k as a factor. This increases the velocity of the descent and diminishes the time. We see here the reason why surcharges tend to produce "white iron;" they not only lower the heat, but they allow less time for the concentration of the ores.

When

$$t = 0 \quad x = 0 \;\therefore$$

for correction

$$0 = ka^3 + \mathrm{C},$$

and

$$t = k\left\{(a+x)^3 - a^3\right\}.$$

For the time to the boshes, we must put $x = h$ the height of the throat above them, which gives

$$t = k\left\{(a+h)^3 - a^3\right\}.$$

In the cone, if b^1 be the half breadth of the boshes

$$a : a+h :: b : b^1,$$

or

$$a : h :: b : b^1 - b$$

$$\therefore a = \frac{bh}{b^1 - b}, \text{ and}$$

$$a + h = \frac{b^1 h}{b^1 - b}$$

$\therefore$ by substituting these values in t and reducing

$$t = k\frac{(b^1-b)^2}{h^2}\left\{\left(\frac{b^{13}-b^3}{b^1-b}\right)h^3\right\}$$

$$= hk\left(\frac{b^{13}-b^3}{b^1-b}\right)$$

$$= hk(b^{12} + b^1 b + b^2)$$

It is easy to perceive that the time of the descent to the top of the crucible will be obtained simply by changing b into b'', the breadth of the crucible, and h into h', the height of the boshes; the whole time is, therefore,

$$\mathrm{T} = k\left\{\,(b'^2 + b'b + b^2)\,h + (b'^2 + b'b'' + b''^2)\,h'\,\right\} + \mathrm{A}.$$

A, being the empirical constant to be determined by observation, as explained above.

If we return to the expression for the velocity (1), some important remarks present themselves.

The degree of preparation of the ore in the upper regions of the furnace will evidently depend on the degree of rapidity with which the charges pass through those regions; and this, again, will depend on the relation between x and y, which defines the internal form of the furnace. We may assign at pleasure any form according to the degree of cementation which we require. Uniform descent obviously requires a cylinder, and this the formula gives.

A descent which retards the charges as

$$x^3\left(\frac{dx}{dt} = \frac{p^3}{x^3}\right)$$

gives y proportional to x, which requires *a cone*, the form in common use.

One which retards them, as x, will require a *common parabola;* one which retards them, as x^3, a *semi-cubical parabola*, &c., &c.

It is needless to multiply cases; it is already obvious that the *nature* of the product in metal (gray, white, mottled, &c.) must depend much (*inter alia*) on the *time* of the detention of the ore up above, and the *stages* of heat it goes through, the blast and all other data (expressed by k) being the same.

Suppose the *scale of heat* upwards to be known, and that we wish to detain the ore for a given time, say between a red heat and a cherry-red heat.

† That to the tuyeres is readily found and added.

Let x', x'' be the two points on this scale t', t'', the times corresponding; t_1 the given time: then

$$t' = k\left\{ a + x')^3 - a^3 \right\}$$
$$t'' = k\left\{ a + x'')^3 - a^3 \right\}$$
$$\overline{t_1 = k\left\{ (a + x')^3 - (a + x'')^3 \right\}}$$
$$= k\left\{ 3\,a^2\,(x' - x'') + 3\,a\,(x'^2 - x''^2) + (x'^3 - x''^3) \right\},$$

whence t_1, k, x', x'' being all known, a can be found. Then, as

$$\frac{bk}{b' - b} = a_1,$$

we can determine the ratio of b to b', and thence the form of the furnace required.

As a practical application of this result (for example) the magnetic ore runs into a glass at a cherry-red heat, or so, and then becomes intractable, but, by detaining it until it is cemented, so as to remove the peroxide, it becomes infusible at that heat, and descends through it without mischief. This scale of heat (for various fuels) might be determined, by appropriate experiments, with tolerable approximation. Other applications of the formula will occur to the intelligent reader, which he can make for himself. In the mean time, the further prosecution of this subject will be for the present adjourned.

SWEDENBORG'S DISCOVERY OF THE DECOMPOSITION OF WATER.

The *London Intellectual Repository* has an article on Swedenborg's Principia—subject, WATER—which that great *savant* announced half a century before its acknowledged discovery to be "like air, capable of decomposition, and of becoming a constituent of all compound substances." "What would be more absurd," asks the commentator, "than to proclaim that water, by dissolution, forms solid salt, and becomes a part of the hard solid rock, or a part of the earth's minerals, vegetables, and animals?" Yet nothing is more true than that such is the case. The housewife who purchases a pound of soap or a pound of alum, gets in exchange three-quarters of a pound of water in the first, and almost one-half a pound in the second. If she buys a score weight of potatoes, she is literally obtaining 15 lbs. weight of water out of 20 lbs. If the butcher sends her 5 lbs. of beef, 4 lbs. thereof are water. And so on with the other substances. Even if we include the bones of the human body, only one-fourth of the whole is solid matter, chiefly the atomic parts of the atmosphere. Hence, the body of a man weighing 10 stone, is 7½ stone of water, and only 2½ of solid material. Chemically speaking, he is 45 lbs. of carbon and nitrogen held in a state of diffusion by 5½ pailfulls of water. By these many quarts of water circulating in a fluid and solid state, warmth, suppleness, and nutriment are transmitted to every atom and fibre of this wondrous mechanism.

Berzelius, in recording this fact, justly remarks that "the living organism is to be regarded as a small mass diffused in water."

Concerning salt, it is asked, "What would be the size of the saline matters constantly held in solution by the earth's seas, oceans, &c., ready for other uses, if they could be separated therefrom, and held in a single block of a cubical form, like the form of a saline particle, or one having six faces at right angles to each other? If the specific gravity of saline matter be taken at 18, and water at 10, and the cubic foot of water weighing 1,000 ounces, then the cubic foot of saline matter will weigh 1,800 ounces, or about 100 lbs. weight; so that the total number of cubic feet will be just 20 that of the tons of salt which have been included in the amount above given, or from hundred thousand billions of cubic feet. However rude this estimate may be, it is considerably under the truth. A cubical block of salt formed from these saline ingredients to the extent above estimated, would exhibit a massive block of salt extending every way, on all sides, about 140 miles. Or, to present it in another form, it would exhibit an extensive *continent* of solid salt, whose superficial extent would cover the whole of Europe, including its islands, seas, &c., and

whose thickness would be the height of the very summit of Mont Blanc, the most elevated mountain on the surface of Europe."

KNOWLES' REGISTERED ILLUMINATING GAS STOVE.

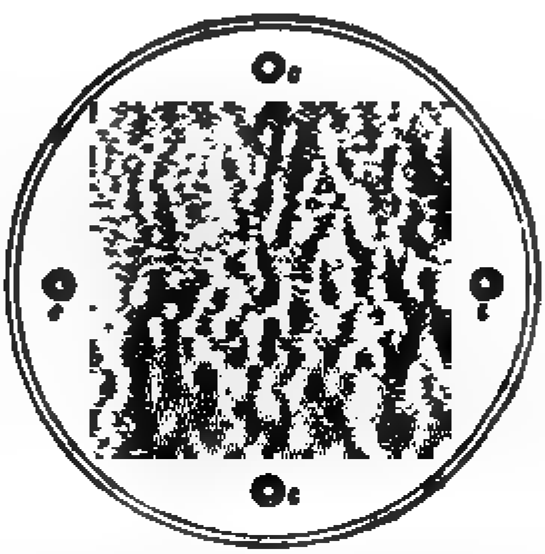
(George Knowles, of Wood-end, Scarborough, Esq., Proprietor.)

Fig 1 is a vertical section, and fig. 2 a horizontal section of this stove. The basement A A is circular, made of cast iron, and is 17 inches in diameter, which

Fig. 1.

breadth by half an inch in depth, measuring from centre to centre transversely across the bottom 18 inches, stands a strong glass cylinder I, 13 inches in diameter and 20 inches high, which is raised on four small pieces of corkwood, affording a space all round for the admission of cold air. At the top of this glass cylinder is a rim B of cast metal, which encircles it, and on the upper side of this rim a sand groove is formed, in which stands the dome K, made of sheet copper, which being about 16 inches high, makes the whole height of the stove about 3 feet 10 inches. The rim is supported by four cast iron pillars C C, three-quarters of an inch in diameter, firmly screwed into the bottom of the stove where the feet are placed, and the rim is again screwed down upon the top of the pillars, which gives an adequate degree of firmness to the whole.

Fig. 2.



In the centre of the bottom is a boss E′ E′, 3 inches high, 5 inches in diameter, and three-eighths of an inch in thickness, to which is attached a stay pipe or cylinder E, 5 inches in diameter within, and rising up in the centre of the stove to the height of 2 feet 6 inches, meeting the funnel of the ventilator in the upper part of the dome. Within the stay pipe is another cylinder D, barely 5 inches in diameter, rising to within an inch in height of the stay pipe, in the centre of which is a water cylinder D, 3 inches in diameter, and of the same height, the space between the two latter being filled with sand. These three cylinders may be made of sheet iron or copper. Surrounding the stay pipe is placed the

reflector G, of a round, segmental, or octagonal shape, 7 inches in diameter, and made of sheet copper, silvered on the outside, or of glass, which, on lifting off the dome K of the stove, can be taken out and cleaned at pleasure. This reflector is of the same height as the exterior glass cylinder. The gas burners H H surround the reflector in two rings, one near the bottom and the other halfway up, 9 inches in diameter, each containing eight burners. One ring only may be used, according to fancy. These rings are connected, and are supplied with gas by means of a pipe introduced at the bottom of the stove, attached to the main. Each ring has its stop-cock, so that one or both may be used at pleasure.

Cold air may be supplied, in addition to the provision before described, by means of apertures in the bottom plate of the stove, worked by a sliding valve, like a common ventilator. The waste of water, in the water cylinder, by evaporation, may be easily supplied by taking off the dome, the amount of waste being ascertainable by means of a small floating buoy.

This stove affords not only heat, but light; and the hot air is tempered and purified by means of the water cylinder, which renders it more fit for respiration than the air of any other stove yet invented. When the stove is used for ordinary purposes, the water in the cylinder is kept below the boiling point,—(say, at from 100° to 160° of heat)—by a very simple contrivance. When used in greenhouses, or in places where much moisture may be required, the sand may readily be removed, and the space it occupies filled with water, which may be allowed to rise to any degree of heat.

The stove may be advantageously used in halls, staircases, rooms, offices, places of worship, and other public buildings.

To suit the smaller class of shopkeepers and others, where much light is not required, the *dome of the stove only* may be illuminated, which will reduce the first cost of the stove.

YOUNG'S REGISTERED ROTARY BOOT AND SHOE-CLEANER.

(Charles Frederic Trelawny Young, of Stockleigh Pomeroy, Devon, Proprietor.)

Fig. 1.

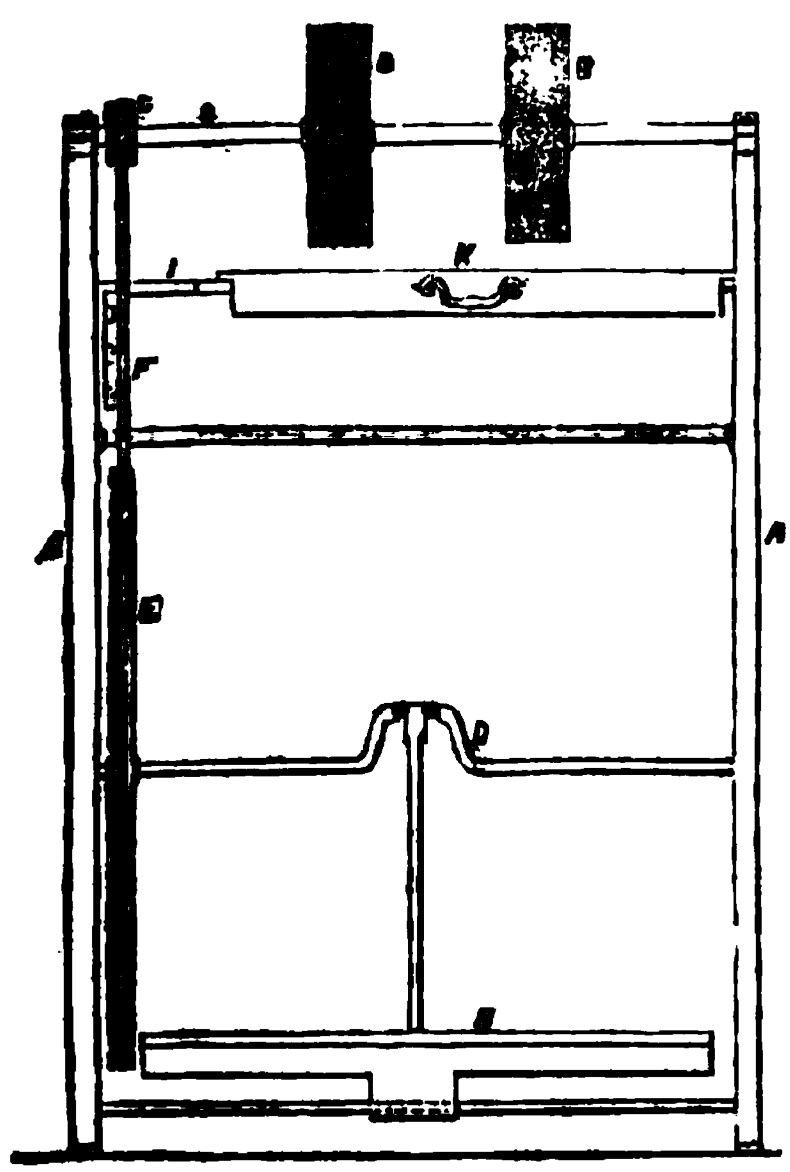


Fig. 2.

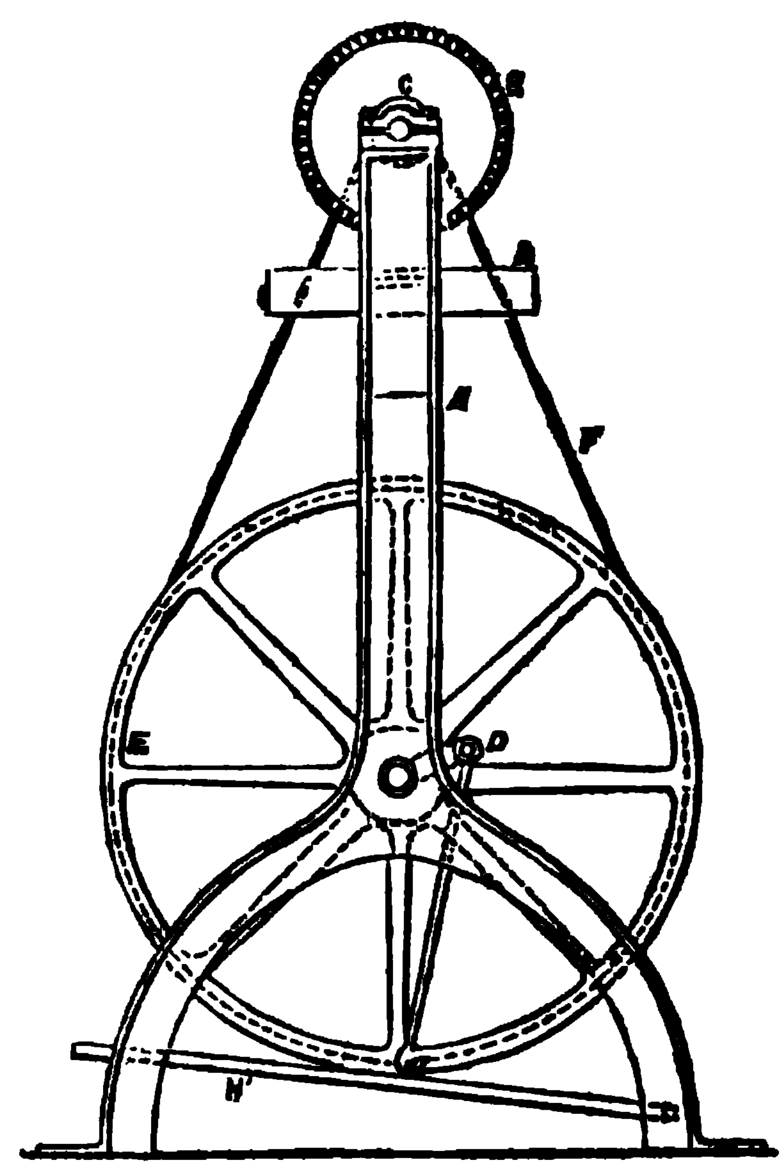


Fig. 1 is a front elevation, and fig. 2 an end elevation of this machine. A A is the framework; B B, a pair of circular brushes, which are mounted on a spindle C. D. a crank axle; E, a cord, or band fly-wheel, from which rotary

motion is communicated to the spindle C and revolving brushes, by means of a band F, and pulley G. H is the treadle; I a shell, and K a drawer for holding the blacking and blacking brush.

AMERICAN DISCOVERIES.—MR. PAINE'S LIGHT—MR. FROST'S "STAME."

SIR,—The go-a-head energetic spirit of the American people appears to pervade and animate even their intellectual pursuits; but unfortunately, in this case, it is neither so appropriately employed, nor is it, nor can it be, so successful in its achievements as when engaged in encountering natural obstacles and material difficulties. Their bold speculations are pushed too far in advance of legitimate induction, to bear any better character than random guesses, and the brilliant scientific discoveries which are so often blazoned rather than announced, seldom stand the test of the now severe and cautious method of European investigation.

Time will show whether there is anything new and valuable in the means Mr. Paine employs in decomposing water by electricity, or rather, as I suppose I ought to express myself in accordance with the new ideas—in converting water into hydrogen gas—but it requires neither time nor hesitation in coming to the conclusion, that the luminous quality of the hydrogen gas, in consequence of passing it through camphine or turpentine, is susceptible of an easy common sense explanation, without resorting to the occult catalysing agency to which Mr. Paine, Dr. Foster, and others attribute it.

Mr. Payne says that the gas is not carbonised, and that there is no loss of turpentine. The first assertion may possibly be true, but the second was contradicted by experimenters at his own house, who found a loss of a teaspoonful of turpentine—quite a rule of thumb mode of experimenting, by the way—but which they good-naturedly attribute to evaporation and the turning it from one vessel into another. Now it is well known, that although hydrogen gas when inflamed emits very few rays of light, it is not necessary that it should, in a chemical point of view, be carburetted in order to become luminous. A very minute quantity of solid matter imparted to it, such for example as may be given to it simply by passing it along a dirty metallic tube, will enable it to afford very considerable light. A small quantity of turpentine vapor would impart sufficient solid carbon to exhibit an immense quantity of light.

It is amusing to observe that the Editor of the "Scientific American" has, according to his own statement, "never heard a single hint relative to hydrogen being a metal." Dr. Foster, however, being better informed, ascribes the luminosity to the "metal vapour" of hydrogen, and considers it analogous to the "carbon vapour of the candle or lamp." Why then imagine that "the camphine so catalyses the hydrogen as to superinduce the development of its metallic energies," unless we are to consider that carbon-vapour is also similarly catalized? If so, or if indeed there exists an anomaly, and only hydrogen requires this catalysing action, what does this mysterious process amount to?—what does it really mean? It must consist in the condensation or precipitation of the gas into exceedingly minute but palpable particles, which it is well known is the phenomenon that takes place in the case of carbon-vapour; the incondescence of these palpable particles being the source of light. It follows, then, that as we can collect soot in the one case, we ought to be able to collect solid hydrogen in the other—a discovery which would indeed immortalize American science. The college where the theory is stated to have been first promulgated should in all justice be the scene of the experiment.

If it be said, in reply, that carbon-vapour, so called, is in reality carbon gas, and that its light giving power, together with that of hydrogen gas—when catalized be it remembered—is not the result of incandescent particles, but of the superinduced development of metallic energies caused by catalysis"—I can only say that an explanation offered in regard to real ignorance, which amounts only to scientifically worded ignorance, is unacceptable even when it is not known to be in opposition to experimental conclusions. I earnestly hope, that however much it may be opposed to received opinions, the greater quantity of hydrogen gas alleged to be produced from a given quantity of electricity, will prove to be better founded on fact, than the illuminating quality imparted to it, is founded on the theory assigned for its explanation.

There is another American discovery —and theory also—which at present claims, or rather clamors for, attention, and that is Mr. Frost's "Stame." To vulgar minds it appears under the character of dry steam and heated steam, just as we think and talk of dry air and heated air. Others have called it "anhydrous steam," which sounds a little more scientific; whether it be correct or not I will not now stay to discuss. But Mr. Frost soars high in the regions of philosophy and discovery, and commands us to call it "Stame;" and undoubtedly as the discoverer of a new substance he is entitled to call it by whatever name he chooses to select,—and "stame" it shall be, when he is pleased to prove to us that it is anything more than heated steam.

"The discovery claimed," says Mr. Frost, "is, that a trivial addition of heat to steam out of contact with water, constitutes it a distinct elementary compound of the same atoms, of enormously augmented volume and value." What the value is as distinct from the volume I cannot imagine, except it be a money value; and truly this *may* be a discovery, and assuredly it is a very commendable quality in a new-found substance, although commercial rather than chemical I opine. It is a comfort, however, to a speculative philosopher to know, that whatever may betide a favourite theory, it is at least *worth* something somewhere. It may be all wrong in a scientific uninteresting point of view, and yet without the precincts of Academic groves, the opinions of more deeply instructed men may be pronounced in the highly significant expression—"it's all right;" for in this masonic phrase with its accompanying symbol is embodied the profound arcana of transcendental knowledge. Professor Renwick is a mere ignoramus in the eyes of Mr. Frost; he has not been initiated, poor man, into this peculiar lore, by which even a neophyte in its mysteries is enabled to *calculate* the value—the *sterling* value—of a new theory, of a new substance, of a new word, in a manner more astute and knowing than any calculus with which mathematicians are acquainted would give them the means to rival.

I would not have indulged in this style of remark if it had not been for the exceedingly offensive and boasting tone of Mr. Frost's lucubrations. Even Dr. Haycraft is assailed with coarse and abusive imputations in return for his far too laudatory notice of Mr. Frost's experiments.

That a new body, "a distinct *element*" as Mr. Frost calls it, is formed when no new properties are imparted to it—that a "distinct elementary compound is constituted," as he phrases it in another place, by simply raising the temperature of a substance, without producing any other than the usual result of increased volume or tension,—is an idea so truly ludicrous, that no notice need have been taken of it, had it not been connected with certain experiments to which a slight degree of importance has been attached, by their having been made the subject of a report of a Committee of Arts and Sciences of the American Institute, of which Professor Renwick appears to have been the chairman and the reporter. These experiments ought to have been much more closely investigated by the Committee than they appear to have been, before giving their sanction, even qualified as it is, to the results they announce. A much better experimenter and observer than Mr. Frost must confirm them before they will be received. Professor Renwick appears to have overlooked the fact, that Sir Humphrey Davy both confirmed and extended the experiments of Gay Lussac on this subject.

With regard to the confirmation of Mr. Frost's discoveries in a practical point of view, as to the economic value of heated steam and as tested by the experimental working of a steam engine, it is worthy of remark, that instead of countenancing his preposterously exaggerated estimate of their worth, the Committee merely observed, that there existed "a very marked and decided superiority in the measure of work performed by the engine when the steam was heated after being generated." This of course was to be expected, and has long been known and acted upon too, although from the practical difficulties connected with the matter it has not received perhaps the full attention it deserves. It is sufficiently explained upon the common-sense principle of converting wasteful watery steam into dry steam, and of slightly increasing its tension by increased temperature. Mr. Frost happily appends something more definite in his supplementary re-

marks, for he gives us data in respect to the working of a steam engine, by which we can judge for ourselves as to the amount of advantage gained by heating the steam; but the examination of this point must be reserved for another communication.

I am Sir, yours, &c.,
BENJAMIN CHEVERTON.

PAINE'S AMERICAN LIGHT.

Sir,—The very strange statements made in some American letters, which have appeared in a recent Number of your Magazine, on "Paine's Light," "Catalysis of Hydrogen," &c., have induced me to make some experiments, by which it is clear to me that the luminosity of the flame from hydrogen passed through turpentine (I have found mineral naphtha to answer better) is due to the carbon, derived no doubt, from the turpentine or naphtha which the gas may absorb in its transmission through the liquid. The presence of carbon in the flame may be easily demonstrated by holding in it a porcelain plate or something of that kind, on which some of the carbon will be deposited.

I think the combination of the liquid and hydrogen is more mechanical than chemical—perhaps analogous to the absorption of moisture by common air. The illuminating power may be almost entirely abstracted by passing the gas through water after having been impregnated with turpentine or naphtha, and completely so, by passing it through oil (I used olive oil). This state of combination may account for the fact that a small proportion of carbon produces a light with hydrogen equal to that produced by a very much larger proportion when *chemically* combined with the hydrogen, as in carburetted hydrogen and light carburetted hydrogen.

So much for the "catalyzed" hydrogen. I have not yet analyzed the rest of the magic.

I advise the American pseudo-philosophers, in attempting to give the *rationale* of phenomena, *new to them*, to give it *rationally*.

I am, Sir, yours, &c.,
JOSEPH W. SWAN.

Newcastle-on-Tyne, Feb. 20, 1851.

AERONAUTICS.—JOURNAL OF THE ASCENT OF MM. BARRAL AND BIXIO, MADE AT PARIS JULY 27, 1850.

This excursion of MM. Barral and Bixio must not be confounded with the ordinary balloon ascensions for the purpose of making the public stare, and gaining money, but was an excursion undertaken by two hardy natural philosophers, for the purpose of solving experimentally certain atmospheric problems, as yet undetermined. Their first excursion, undertaken under the most unfavourable circumstances, was a failure; the second, the journal of which we give below from the proceedings of the Academy of Sciences of Paris, was more successful, although the travellers did not get up as high as they wished; and we understand that they are now busily engaged in preparing a third, for which we hope and expect a still more entire success. The following is the Report by them to the Academy:—

"The principal questions upon which our attention was to be fixed during our second aërial journey, were the following:

"1st, The law of decrease of atmospheric temperature with the height.

2nd, The influence of the solar radiation in the different regions of the atmosphere, deduced from observations made upon thermometers whose reservoirs were endowed with very different absorbing powers.

"3rd, The determination of the hygrometric state of the air in the various atmospheric strata, and the comparison of the indications of the psychrometer with the dew point at very low temperatures.

"4th, Analysis of the atmospheric air at different heights.

"5th, Determination of the quantity of carbonic acid contained in the high regions of the atmosphere.

"6th, Examination of the polarization of light by the clouds.

"7th, Observation of the various optical phenomena produced by the clouds.

"The apparatus placed at our disposal were:

"1st, Two syphon barometers, graduated on the glass, whose upper meniscus we were to observe; the position of the lower meniscus being giving by a Table constructed from direct observations made in the Laboratory. Each of these barometers is provided with a thermometer divided into centesimal degrees.

"2nd, Three thermometers, with arbitrary scales fixed at a distance of 5 centimetres (2 inches) from a metallic plate. The reservoir of the first of these thermometers has a surface of glass; the surface of the second is coated with lamp-black, and that of the third is covered by a cylinder of polished silver, which also envelopes a part

of the stem. The reservoirs are cylinders, narrow, but very long. Immediately below the reservoirs the metallic plate carries a silvered plate very highly polished. The plate, with its thermometers, is placed horizontally on one of the sides of the car, so as to remain constantly exposed to the solar radiation.

"3rd, A vertical thermometer, with an arbitrary scale, whose cylindrical reservoir is placed in the axis of several concentric envelopes of highly polished tinned iron, open below to permit the circulation of air. This disposition was arranged to obtain, at least, approximately, the temperature which a thermometer in the shade would give.

"4th, A psychrometer formed by two thermometers, with arbitrary scales.

"5th, A condensing hydrometer, on M. Regnault's plan.

"6th, Tubes with caustic potassa, and pumice soaked with sulphuric acid, for the determination of the carbonic acid of the air. The aspiration of the air was to be produced by a pump of a capacity of 1 litre, and exactly gauged.

"7th, Two glass globes of 1 litre capacity, provided with steel stopcocks, and intended to collect the air in the high regions. These globes, which were placed in tin cases, had been carefully exhausted of air before our departure.

"8th, A Walferdin minimum thermometer. This thermometer, graduated by M. Walferdin, is enclosed in a tin cylinder, pierced with holes. At our request, this apparatus was placed under seal.

"9th, An apparatus furnished by M. Regnault, and intended to indicate the maximum elevation which the balloon had reached. This apparatus was enclosed in a tin case pierced with a great number of holes. The cover of the case was also sealed.

"10th, An Arago Polariscope.

"The instruments with scales were made by M. Fastré, under the direction of M. Regnault. The Tables for the graduation were calculated in the Laboratory of the College of France, and were known to M. Regnault alone.

"The balloon is that of M. Dupuis-Velcourt, which had served for our first ascension, but the lower orifice terminates in a cylindrical tube of silk of 7 metres (22·96 feet) in length, which remained open to allow the gas to escape freely during the ascent. The car was hung about 4 metres (13·12 feet) below the orifice of the silk tube. The instruments were hung around a large ring of sheet iron, which was attached to the usual wooden hoop which carries the cords of the car. The form of this ring is such that the instruments were placed at the proper distance from the observers.

"The plan was to ascend about 10 o'clock, A.M.; all the arrangements were taken to have the filling of the balloon begun at six o'clock. This operation was confided to MM. Veron and Fontaine.

"Unfortunately, circumstances beyond our controul caused injurious delays, as the balloon was not ready until one o'clock. The sky, which until noon had been very clear, was covered with clouds, and very soon rain fell in torrents on Paris. The rain did not cease until three o'clock. The day was too far advanced, and the atmospheric circumstances were too unfavourable for us to hope to fulfil the proposed programme. But the aërostat was ready, great expenses had been incurred, and observations in such a disturbed atmosphere might lead to useful results. Our departure took place at four o'clock; it presented some difficulties, in consequence of the very limited space which the garden of the Observatory afforded for the operation.

"One of the barometers was broken and left behind. The same accident happened to the thermometer with blackened bulb.

"We here transcribe the notes which we took during our ascent:

"4h. 3m. Departure. The balloon rises at first very slowly, moving towards the east; after throwing out several kilogrammes of ballast, it takes a more rapid ascensional movement. The sky is completely covered with clouds, and we soon find ourselves in a light haze.

"4h. 6m.	Barometer	694·70	mm. attached thermometer		+16° C.	Height=	757 metres.
"4h. 8m.	,,	674·96	,,	,,	16	,,	999
"4h. 8m. 30 sec.	,,	655·57	,,	,,	13	,,	1244
"4h. 11m.	,,	636·68	,,	,,	9·8	,,	1483*

* All the barometric heights given have been reduced to the temperature 0° by calculation. By means of the barometric and thermometric observations made at the Observatory and in the car, the heights of 19 stations above the Observatory, and above the sea by adding 65 metres to them, were calculated. But the three heights, 6512, 7016, and 6765 metres, where the temperature had fallen to −35° and −39° were obtained by comparison, not with the Observatory, but with the intermediate station, 5902 metres, where the temperature was −9·8°, and the pressure 367·04mm. We thus find 7004 metres for the highest station. But there must still be added a correction of 12 metres due to the height, 5902 metres, of the lower station compared, which makes in all 7016 metres (23018·33 feet, or 4·36 miles). This is exactly the height reached by Gay-Lussac and Biot.

"Above us a continuous mass of clouds; below us, detached clouds, which seem to roll towards Paris. We feel a fresh breeze.

"4h. 13m.	Barometer	597·73 mm.	attached thermometer	+9·° C.	Height	2013 metres.
"4h. 15m.	,,	558·70	,, ,,	9·	,,	2567
"4h. 20m.	,,	482·20	,, ,,	−0·5	,,	3751

"The cloud into which we are penetrating presents the appearance of a common very thick fog: we no longer see the earth.

"Barometer 405·41 mm. attached thermometer − 7°. Height 5121 metres.

"Some rays of the sun become perceptible through the clouds.

"The barometer oscillates between 366·99 and 386·42; the thermometer − 9°; height from 5911 to 5492 metres.

"The balloon is completely distended; the tube appended, which up to this time had remained flattened under the pressure of the atmosphere, is now distended, and the gas escapes by its lower orifice, as a whitish streak; we perceive its odour very distinctly. A tear is found in the balloon at the distance of 1·5 metres from the origin of the tube. A clearer space shows itself, and allows the position of the sun to be vaguely seen.

"After again throwing over some ballast, the balloon resumes its ascent.

"4h. 25m. Barometer oscillates from 347·75 mm. to 367·04; thermometer − 10·°5 to − 98·°; Height 6330 − 5902 metres.

"The mist, much less intense, allows a white and feeble image of the sun to be seen. Barometer oscillating. We are covered with little icicles in extremely fine needles, which collect in the folds of our clothes. During the descending period of the barometric oscillation, that is, during the ascending motion of the balloon, the note-book opened before us receives them so that they appear to fall upon it with a kind of crepitation. Nothing similar shows itself during the ascending period of the barometer, that is during the descent of the aërostat.

"The horizontal thermometer with glass bulb gives—4·°69.
,, ,, silvered ,, −8·°95.

"We see distinctly the disk of the sun through the frozen fog, but at the same time, *in the same vertical plane, we see a second image of the sun nearly as intense as the first; the two images appear symmetrically placed above and below the horizontal plane of the car, each making an angle of about* 30° *with this plane.* This phenomenon was seen for more than 10 minutes.

"The temperatare falls very rapidly; we attempt to make a complete series of observations upon the thermometer for radiation, and on the thermometers of the psychrometer, but the mercurial columns are hidden by the corks, because so sudden a fall of the temperature had not been foreseen. The thermometer with the coverings of tin plate gives—23·°79.

"4h. 32m. The clouds separate above us, and we see a place in the sky of a light azure blue, like that which on a clear day is seen from the earth. The polariscope shows no polarization in any direction on the clouds, in contact with us, or further off. The sky-blue is, on the contrary, strongly polarized. Barometer oscillates. Ballast thrown out, by which a new ascending movement is obtained.

"4h. 45m. Barometer 338·05 mm. attached thermometer—35°. Height=6512 metres.

"Our fingers are stiffened with the cold, but we experience no pain in the ears, and the respiration is not at all obstructed. The sky is again covered with clouds, but the clouded sun and its image are still visible. We throw out ballast, which gives a new ascent.

"4h. 50m. Barometer 315·02. The extremity of the attached thermometer is about 2° below the lowest division traced on the instrument. This division is—37°; the temperature was then about—39°; height 7016 metres.

"The barometer oscillates from 315·02 to 326·20; thus the aërostat oscillates from 7016 to 6765 metres. We had but 4 kilogrammes of ballast left, which we deemed prudent to keep for our descent. We hoped to keep ourselves for some time at this height, but although the silk tube was raised up to avoid the exit of gas from its orifice, the balloon begins its descent. We take the air for examination. The tube of one of the globes is broken by the efforts made by us to turn the stop-cock. The second is filled with air without accident.

"5h. 2m. Barometer 436·4; temperature—9°. Height 4502 metres.

"We again meet the little needles of ice.

"5h. 07m.	Barometer 483·16.	temperature —7°.	Height	3688 metres.
"5h. 10m.	„ 540·39.	„ —3°.	„	2796
"5h. 12m.	„ 559·70.	„ —1°.	„	2452
"5h. 14m.	„ 582 90.	„ 0°.	„	2185
"5h. 16m.	„ 598·5 to 618	„ +1·°8	„	1973 to 1707

"These oscillations were produced by the last portions of our ballast which we threw out. We think of nothing but moderating our descent by sacrificing every thing disposable except the instruments, and we put the thermometers in their cases.

"5h. 30m. Reached the earth, at the hamlet des Peux; commune de Saint Denis-les-Rebais; arrondissement de Coulommiers, (Seine et Marne,) a short distance from the residence of M. Brulfert, the Mayor of this commune, situated 70 kilometres (43½ miles) from Paris. We were so fortunate as not to break any of the instruments in the descent. We found at the village nothing but a cart to carry us to the nearest station of the Strasburg railroad, which is 18 kilometres (11·18 miles) distant. The journey was a severe one over the cross roads; the horse fell. Two of the pieces of apparatus which we were the most desirous of bringing back to Paris unhurt were broken, or rendered valueless; the globe of air, and the instrument which indicated the minimum barometric pressure. Happily the minimum thermometer of M. Walferden was brought back with its seal unhurt, to the College of France.

"This seal was removed by MM. Regnault and Walferdin, and the minimum temperature, determined by direct experiments, was found—39·67, consequently differing very little from the lowest temperature which we ourselves had observed on the thermometer attached to the barometer.

"At the request of M. Regnault, MM. Person at Besançon; de Breauté at Dieppe; Bertin at Strasburg; Hœghens at Versailles; Monod at Orleans; Renou at Vendôme; Malaguti at Rennes; Girardin and Bouton at Rouen; and Isidore Pierre at Caen, made, during the 26th and 27th July, barometric and thermometric observations every quarter of an hour."

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK, ENDING FEBRUARY 27, 1851.

WILLIAM EDWARD NEWTON, of Chancery-lane, civil engineer. *For improvements in refining gold.* (A communication.) Patent dated August 22, 1850.

The present improvements in the art of refining gold consist

1. In reducing argentiferous or any other gold bullion to a granulated, or spongy, or disintegrated molecular condition by fusion therewith of zinc, or some other metal baser than silver, and the subsequent removal of the zinc by dilute sulphuric or other acid; that is, the reducing of the gold bullion to a state to allow of the removal by acids of the silver and other impurities contained therein, so as to fit it for coinage and other purposes without quartation with silver or any other intermediate process. And

2. In pulverizing by grinding or concussion gold bullion, rendered brittle by union with lead, solder, or other suitable metal, the silver and other impurities being removed by acids in this as in the preceding case, and recovered from the acid solution by any of the known chemical means.

This operation, if properly conducted, will produce fine ductile gold in a state of great purity; that is, containing from 98·5 to 99·5 per cent. of pure gold.

WILLIAM DICK, professor of veterinary medicine, Edinburgh. *For improvements in the manufacture of steel and gas.* Patent dated August 22, 1850.

This invention consists in the manufacture of steel and gas in the same retort, at one and the same time. The patentee employs the common fire-clay gas retorts, in which the bars of iron to be converted into steel, and which should be of a length about equal to that of the retort, are disposed horizontally—a thin layer of coke being interposed between them and the floor of the retort. The retort is then charged and re-charged in the ordinary manner, and at the usual intervals, with coal or other material capable of generating gas. The bars of iron are turned every two or three days, when a fresh charge is introduced, and are allowed to remain in the retort for a longer or shorter period according to their thickness and size, until the process of cementation is completed. This may be tested by taking out a bar, cooling it suddenly, and then breaking it—the absence of "pith" from the centre indicating the completion of the process.

Mr. Dick observes that he lays no claim to the employment of carburetted hydrogen shut up in a close chamber with bars of iron, for the purpose of converting them into steel; but he claims the manufacture of steel and gas at one and the same time, in the same retort or furnace.

EDMEE AUGUSTIN CHAMEROY, of Paris. *For improvements in paving streets and other surfaces.* Patent dated Aug, 22, 1850.

M. Chameroy proposes to employ, as a

covering for roads, pavements, the floors of barns, and other surfaces, compressed straw, or the stalks of plants, saturated with bituminous, resinous, asphaltic, or fatty or oily matters, either laid down in lengths or made into blocks.

Several arrangements of apparatus are described in the specification as suitable for compressing and laying down pavements of this description.

Claim.—The covering of roads and other surfaces with the combination of materials described.

BENJAMIN ROTCH, of Lowlands, Middlesex, Esq. *For a factitious saltpetre, and a mode by which factitious saltpetre may be obtained for commercial purposes.* (A communication.) Patent dated Aug. 22, 1850.

In the manufacture of a factitious saltpetre from nitrate of soda and crude carbonate of potash, where the required causticity is obtained by the action of lime, the patentee takes a quantity of crude carbonate of potash reduced to powder, lixiviates it, and boils the solution in a round iron pan till it attains a density of 40° to 45° of Baumé. It is then allowed to stand for a time, when any undecomposed sulphate of potash will precipitate, and should be removed, after which the clear liquor is to be decanted off, and allowed to cool. At the expiration of five or six days this liquor is heated to about 175° Fahr., and diluted with water to a density of 15° Baumé; a quantity of burnt lime equal to about twenty-five per cent. of the original quantity of carbonate of potash is then added, and well stirred in till the solution becomes caustic, when, after standing for a time, to allow of the precipitation of any carbonate of lime that may be held suspended in it, the clear liquor is to be drawn off, and concentrated by heat and evaporation to 25° Baumé, when a caustic potash suitable for the manufacture of saltpetre will be produced.

While this operation has been going on, about 800 gallons of water should have been placed in another iron pan, and 2,000 lbs. of nitrate of soda dissolved therein; a second quantity of 200 gallons of water being gradually added, and the solution boiled to a density of 42° to 45° Baumé. This solution is allowed to stand for about twelve hours to settle and cool, and is then, together with the clear liquor of the previous solution, run into a crystallizing pan, where the mixture is heated to, and maintained for about three hours, at a temperature of from 176° to 212° Fahr., and then gradually cooled down to about 54° to 50° Fahr., when the principal portion of the nitrate of soda will have crystallized after conversion into saltpetre. The crystals are to be collected from the mother water, placed in a centrifugal drying machine, washed with some of the weak mother water, dried by the action of the machine, and then removed for use. The saltpetre thus produced will be equal to the best refined Bengal. (In order to ascertain the proportions of alkali and pure nitrate of soda contained in the solutions previous to mixing, they must be analysed, and the relative and necessary proportions, say 36 parts of pure caustic alkali to 48 parts of pure nitrate of soda, carefully secured in the respective solutions.)

The specification contains also a method very similar to that above described of making saltpetre from nitrate of soda and American potashes, and from pearl-ashes. In any case where the materials employed do not possess a sufficient degree of causticity, the addition of lime will be rendered necessary, as upon the principle of causticity depends the essence of the invention. The carbonate of soda and saltpetre remaining in the mother liquor after the crystals (produced by any of the above processes) have been removed, are to be separated by concentrating the liquor to about 45° Baumé, and then allowing it to cool, when the crystals of each of these substances form, and may be readily removed.

The patentee states that the alkali obtained by lixiviating the ashes of burnt tobacco may be employed in the manufacture of saltpetre.

Claims.—1. Factitious saltpetre manufactured by the double conversion of nitrate of soda into nitrate of potash, and carbonate of potash into carbonate of soda, by the agency of causticity.

2. The manufacture of the same from nitrate of soda and crude carbonate of potash, rendered caustic by the addition of lime.

3. The manufacture of the same from nitrate of soda and American potashes without any addition of lime.

4. The manufacture of carbonate of soda and caustic soda in the process of manufacturing factitious saltpetre by the double conversion of nitrate of soda into nitrate of potash and carbonate of potash into carbonate of soda and caustic soda.

5. The application of the alkali obtained from the ashes of burnt tobacco to the manufacture of factitious saltpetre.

6. The application of the ordinary centrifugal drying machines to the manufacture of saltpetre.

WILLIAM EDWARD NEWTON, of Chancery-lane, civil engineer. *For improvements in machinery or apparatus for producing ice, and for general refrigerating purposes.* (A communication.) Patent dated August 22, 1850.

These improvements are based on the

well-known physical law that air, when compressed, surrenders a portion of its heat, which it again absorbs during expansion from any substance with which it is brought in contact.

The specification contains a description of an apparatus embodying this principle, which is applicable not only to freezing water, but to cooling worts in breweries, ventilating ships, and maintaining a low degree of temperature when requisite for manufacturing or other purposes.

Claims.—1. A means of effecting the absorption of the heat evolved during the process of compressing air in the condensing engine, by the use of alcohol or other uncongelable liquid.

2. The construction and use of a machine for obtaining a gradual and regular expansion of the compressed air, and for applying the power exerted by the expanding air to aid in working the condensing engine.

3. The use of a chamber or receiver where the water and air may separate previous to the p ssage of the latter to the main reservoir.

4. A peculiar construction of chamber communicating by tubes with the cylinders or receivers, in which the compression and expansion of the air are effected.

5. A method of utilizing the expanded air, and rendering it available by recondensation.

Duncan Bruce, of Paspebiac, Gaspe, Canada, Esq. *For certain improvements in the construction of rotary engines.* Patent dated August 22, 1850.

From the imperfect manner in which this specification is drawn, and the absence of specific claims, it is next to impossible (without the expenditure of more time than we have the inclination to bestow on it) to ascertain what are the improvements here sought to be secured.

A method of applying springs, similar in construction to carriage springs, to the packing of the steam wheel, appears to possess some degree of novelty.

[The apparatus here specified is apparently that of Dr. Gorrie, described by a Cuban correspondent in No. 1434, p. 87.]

William Edward Newton, of Chancery-lane, civil engineer. *For improvements in the construction of ships' magazines.* (A communication.) Patent dated August 22, 1850.

Claims.—1. Attaching a connecting piece made of some easily-melted or fusible mate rial to, and connecting the same with, the governing cocks of the injection and ejection pipes employed for maintaining a circulation of cold water through the magazine, or for flooding it when required—such connecting piece being made of such material (gutta percha is specified), and adapted to the magazine or governing cocks connected therewith in such manner as to be affected by heat without necessarily coming in contact with fire, and being also governed by a spring, and capable, when acted on by heat, of liberating certain other parts, which will open the cocks and flood the magazine.

2. Attaching to and combining with the magazine a double tube or cylinder, or equivalent arrangement, by which articles may be conveyed into or from the magazine, without in any way exposing the interior to fire from without, by which several arrangements a perfect security is effected against firing the magazines of vessels of war.

Frederick Hale Thomson, of Berner's-street, gentleman, and Thomas Robert Mellish, of Portland-street, glass-cutter. *For improvements in cutting, staining, silvering, and fixing articles of glass.* Patent dated August 22, 1850.

The improvements comprehended in this specification are—

1. A method of sawing or cutting-out figures from or in sheets of glass, by means of a metal wire stretched in a suitable frame, and moved up and down, and at the same time caused to revolve so as to bring all its surface into equal contact with the glass to be cut. The wire is to be kept supplied, as customary, with emery or other cutting powder. In cutting out figures in a sheet of glass, a hole is first drilled, through which one end of the wire is passed, and then secured to the frame. The plate is to be kept in contact with the wire according to the figure or pattern to be cut out.

2. Cutting out any device or border at the back of a sheet of glass, then colouring the device or border so cut out, and silvering the whole of the back, or removing a portion of the coloured part by a second operation of cutting, and then silvering the back. The appearance produced will be that of a border in relief. For silvering glass the patentees employ a mixture composed of 1 oz. spirits of hartshorn or ammonia, 2 ozs. nitrate of silver, 3 ozs. spirits of wine, 3 ozs. water. One ounce of this solution is mixed with a quarter of an ounce of grape sugar, and a quarter of a pint each of water and spirits of wine; and, when filtered, is ready for use. It is applied to the glass, previously heated to about 160° Fahr., and allowed to remain in contact therewith till the silvering is effected.

3. Staining a pattern on glass, and then silvering the back.

4. Uniting two pieces of stained or ornamented and silvered glass by means of white wax, so as to exhibit two ornamental faces.

5. A clip for connecting glass to other surfaces.

Claim.—Th[illegible] particulars of invention described.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Henry Richardson, of Aber Houran Balor, North Wales, esquire, for certain improvements in life-boats. February 22; six months.

William Stones, of Queenhithe, London, stationer, for improvements in the manufacture of safety-paper for bankers' cheques, bills of Exchange, and other like purposes. February 24; six months.

Edward Lloyd, of Dee Valley, near Corwen, Merionethshire, North Wales, engineer, for certain improvements in steam engines, which improvements are in part or on the whole applicable to other motive engines. February 24; six months.

Peter Wood, of the firm of Bury and Co., dyers, finishers, and calenderers, of Salford, Lancaster, for improvements in printing, staining, figuring, and ornamenting woven and textile fabrics, wood, leather, or any other material substance or composition, and in machinery and apparatus employed therein. February 24; six months.

John Hinks, of Birmingham, manufacturer, and James Vero, of Burbage, Leicester, manufacturer, for certain improvements in the manufacture of hats, caps, bonnets, and other coverings for the head. February 24; six months.

Gabriel Didier Fevre, of Paris, France, gentleman, for certain improvements in apparatus for manufacturing and containing soda-water, and other gaseous liquids, and also in preserving other substances from evaporation. February 24; six months.

Thomas Wicksteed, of Old Ford, Middlesex, civil engineer, for improvements in the manufacture of manure and in machinery to be used therein. February 24; six months.

Robert Adams, of King William-street, London, gun-maker, for improvements in rifles and other fire-arms. February 23; six months.

Francis Clark Monatis, of Earlston, Berwick, builder, for an improved hydraulic syphon. February 23; six months.

Isaac Lowthian Bell, of Washington Chemical Works, near Newcastle-upon-Tyne, chemical manufacturer, for improvements in the manufacture of sulphuric acid. February 23; six months.

Henry Dircks, of Moorgate-street, London, engineer, for improvements in the manufacture of gas, in gas-burners, and in apparatus for heating by gas. February 23; six months.

Charles Frederick Bielfeld, of Wellington-street North, Strand, papier maché manufacturer, for improvements in the manufacture of sheets of papier maché, or substances in the nature thereof. February 24; six months.

Samuel Cunliffe Lister, of Manningham, near Bradford, York, for improvements in preparing and combing wool and other fibrous materials. February 24; six months.

Robert Hawthorn and William Hawthorn, of Newcastle-upon-Tyne, engineers and partners, for improvements in locomotive engines, parts of which are applicable to other steam engines. February 24; six months.

Amedée François Remond, of Birmingham, gentleman, for improvements in the manufacture of metallic tubes or pipes, and the machinery or apparatus connected therewith, which improvements are applicable to other like purposes. February 25; six months.

Thomas Ellis the elder, of Tredegar Iron-works, Monmouth, engineer, for certain improvements in machinery or apparatus to be employed in the manufacture of blooms or piles for railway and other bars or plates of iron. February 27; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Feb. 20	2702	S. Cocker and Son	Sheffield	Circular file driven by mechanical power.
"	2703	S. Pearce	Bath	The Sevigne stay.
"	2704	J. Cartland and Son	Birmingham	Swing glass.
"	2705	H. Room	Birmingham	Shower-bath.
21	2706	Thornton and Killick	Ludgate Hill	The Anuphaton collar.
"	2707	J. Beasley	Spalding	Machine for cutting chicory and other roots.
22	2708	Sharp, Brothers, and Co.	Manchester	Ring and traveller for a throstle.
"	2709	J. Warner and Sons	Crescent, Jewin-street	Ventilating brick.
24	2710	J. D. Durham	Linton-street, New North-road	Hot-air funnel kettle.
"	2711	J. Hooper and J. Bullock	Moseley, near Birmingham	Ventilator.
25	2712	B. Sawdon	Huddersfield	Gas retort.
26	2713	T. Eyles	James-street, Bath	Eyle's folding table.
27	2714	H. and S. Schloss	Friday-street	"Multum in parvo" pocket-book, or porte cigar.

CONTENTS OF THIS NUMBER.

Description of Registered Chicory-Cutting Machine. By John Beasley, Esq., B A—(*with engravings*) 161

Vindication of Mr. Bills' Extension of Horner's Method. By Mr. Bills 162

On Seasoning Wood on a small scale. By "M. S. B." 165

On the Form of the Interior of Blast Furnaces, and on the Descent of their Charges. By Sir F. C. Knowles, Bart 166

Swedenborg's Discovery of the Decomposition of Water 169

Description of Knowles' Registered Illuminating Gas Stove—(*with engravings*) 170

Description of Young's Registered Boot and Shoe-Cleaner—(*with engravings*) 171

American Discoveries.—Paine's Light—Mr. Frost's "Stame." By Benjamin Cheverton, Esq. 172

On Paine's Light. By Joseph S. W. Swan, Esq. 174

Æronautics.—Journal of the Ascent of MM. Barral and Bexio 174

Specifications of English Patents Enrolled during the Week:—

Newton ..... Gold Refining 177
Dick ..... Steel and Gas 177
Chameroy ..... Paving 177
Rotch ..... Saltpetre 178
Newton ..... Ice-making 178
Bruce ..... Rotary Engines 179
Newton ..... Ships' Magazines 179
Thomson & Mellish ... Glass 179

Weekly List of New English Patents 180

Weekly List of Designs for Articles of Utility Registered 180

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1439.] SATURDAY, MARCH 8, 1851. [Price 3d., Stamped, 4d.

Edited by J. C. Robertson, 166, Fleet-street.

PAINE'S MAGNETO-ELECTRIC MACHINE AND LIGHT.

Fig. 5. Fig. 6. Fig. 4.

PAINE'S MAGNETO-ELECTRIC MACHINE AND LIGHT.

The apparatus by which the gas is obtained, from which Mr. Paine derives his much-talked-of light, having been now patented on his behalf in England (in the name of Mr. A. V. Newton) and the specification of it enrolled, we have it now in our power to lay a full description of the same before our readers.

Specification.

My invention mainly consists in certain improvements in magneto-electric apparatus for decomposing and resolving water and other fluids, and applying the gases evolved therefrom, or elements thereof, to various practical purposes.

In the construction of magneto-electric machines, I have made improvements in essential parts, which give the command of greatly increased power, and admit of the electric force being brought to bear in a novel manner upon the subject to be acted upon. Adhering generally to the ordinary form of the helices, I substitute for the common heliacal coil an insulated coil of hollow wire or tubing of copper or other good conducting metal, and this hollow wire or tube I fill at pleasure with water or other electrical absorbent. This arrangement has not only the merit of giving a greatly increased surface (the inner and outer surfaces of the coils) for the electrical currents, but it also admits of great accumulation, the water or other absorbent taking up the excess during each revolution, and retaining the same till relieved by the action of the dischargers, as after explained.

These tubular coils should be made of some metal that will not easily corrode or oxidate, and must be insulated externally—or they may be made of some non-conducting substance (such as gutta percha) filled with the liquid, and a metallic wire inserted therein. It has been found that electricity when applied in a continuous or unintermitting current cannot be used as a successful agent in decomposing water or other fluid in sufficient quantities, and at a cost that will allow of the application of the products to general purposes; but I have discovered that when the electric current is made to enter the water in a series of discharges or pulsations, great quantities of gases may be evolved, and at a very moderate cost.

My improvements admit not only of the discharge of the electric fluid in pulsations, but of its accumulation to any required extent between any two pulsations or discharges.

AA (figs. 2 and 3) are two helices, the interior or cores of which may be of soft iron, or of hollow wire filled with water; and coils of hollow wire also filled with water are wound round the cores, and the ends connected together as at K (fig. 2).

These helices are made to revolve by clockwork, or other simple motive power, between the poles of a pair of permanent magnets BB, upon one common spindle C. On the head of the spindle is an insulated cap D, with two metallic rings, placed one around its vertical edge E, and the other its top E, each being insulated from the other; the termini of the heliacal coils FF are attached one to each ring EE. (The small rod that connects the discharging rings EF on the spindle-head D, with the hollow heliacal coils, should be split its entire length, in order that when it enters the hollow coil it may convey the fluid up towards the rings, and allow the electricity to enter the water.) Now, instead of having friction dischargers pressing against these rings, the discharger is made as follows:—A wheel, G, of the required diameter, with its periphery covered with some good non-conducting substance, except at one point H (fig. 6) (which must be a good conductor) is made to press by means of a spring-arm I, against the ring E on the spindle-head; the stud K, which supports the spring-arm, being insulated, and the conducting wire, J, starting from the arm I. By this arrangement no discharge from the helices can take place until the non-insulated point H, on the discharging wheel, comes in contact with the ring E, and consequently as the diameters of the ring and the wheels are proportionate, so will the amount of accumulations between the discharges be.

The electrodes (figs. 4 and 5) are constructed upon the principle of conveying the currents on large free conductors terminating in a great number of radial points (1, 1); the negative pole (2), or pole points, radiating from a common centre around and along the conductor's terminus and the positive pole points (3), converging from the interior of a cylinder or cell (4) to which the positive conductor (3) is attached; and so *vice versâ*, when the positive pole enters the cell and the negative is attached to its interior. The top of the cell (5) is pierced with numerous small holes, and its bottom (6) with an aperture of about one-sixth its diameter. The conductors should be insulated, so as not to come in contact with the water at any time or place; which may be effected either by passing them through glass tubes, or some non-conducting material, or by coatings of some non-conducting surface. Copper or other metallic cells or cylinders may be used, but the

electrodes and the radial and converging points I prefer making of fine platinum. The points on the interior of the cell or cylinder may be dispensed with, and the central or radial points of the electrode be made to come nearly in contact with the cylinder's surface; but practice has proved that this arrangement is not so good as the double points.

[Another arrangement of the electrodes is here described, in which the negative wire of platinum is soldered to one of the conductors, and the end is wound in the form of a spiral, making a cylinder of about one inch long and three-eighths of an inch in diameter; into which coil the positive wire is inserted, the lower end being soldered to a metallic button at the under end of the negative coil. This arrangement may be reversed when opposite effects are desired.]

In decomposing water, the cell or cylinder, with the electrodes properly arranged and attached, is plunged into a tank or vessel of convenient shape, filled with water. The effect of the arrangement of electrodes, above described, is to isolate as it were a certain quantity of water in the cells or spirals, and to bring to bear upon it, by a series of pulsations or intermittent discharges, the accumulated force of the electric fluid, and thus the gases are evolved with extraordinary rapidity. In experimenting with water, I recommend that it be distilled or boiled, in order to get rid of the atmospheric air.

[A third modification or form of the electrodes is next shown; in which arrangement the negative pole is attached to the inner side, or top of the cell or cylinder. The positive pole passes down into the cell about one-third of its depth, terminating in a plate of copper or other good conducting metal. From this plate a number of platinum wires or points extend downwards into the centres of a corresponding number of spirals or coils, also of platinum, which are attached to the bottom of the cell. In this arrangement (as well as in the second) the exterior of each coil or spiral must be coated with some non-conducting substance, as well as the exterior of the cell.]

A given quantity or force of the electric fluid is required to decompose water, and any excess interferes with its decomposing power, and causes a repulsive action at the electrodes, subjecting them to injurious action. In order to guard against this difficulty, a governor (9) is constructed as follows:—

The conductors J are made to connect with the helices around the electro-magnet N, and then pass to the insulated mercurial cylinder P. A platinum bar Q slides into this mercury, and is connected with the end of a balance beam R, which has at its opposite end a similar platinum bar, and a mercurial cylinder S, and from the latter proceeds the conductor T to the electrodes in the water or other fluid to be decomposed. Attached to the beam R, directly over the poles of the electro-magnet, is a keeper or armature W. Taking advantage of the well-known law, that the more intense the current passing around the legs of an electro-magnet the greater the power, it is readily perceived that as all currents passed into the fluid to be decomposed, are first made to pass around the electro-magnet N, there is consequently a continued force acting on the beam R, through the armature W, and the action of this force may be easily graduated and governed by placing a spring S^2, so as to act on the beam on the opposite side of its fulcrum.

Now when the beam is so adjusted that when the proper decomposing action is obtained, the spring balances the power of the magnet, it will be evident that when the action increases, the power of the magnet will overcome that of the spring; the beam will be drawn down, and the plantinum bar in the mercury *g* drawn out, and thus break the connection, and keep it broken till the excess has ceased. It has been sometimes found that when the current is suddenly broken by drawing out the bar in the cylinder *g*, a vacancy or partial vacuum is formed, into which the mercury rises, and is consequently spilt; a result which terminates the action of the machine until the mercury is replaced. In order to avoid this difficulty, an auxiliary cylinder Z, is placed under the beam, between the conducting cylinder P and the electro-magnets N. This cylinder is filled with mercury like the other, and has a platinum bar X attached to the beam R, which works into it like the other bar. The mercury is gauged in this cylinder, so that the bar shall enter the mercury before the bar *g* leaves its bath, and so turn the current into the cylinder, upon which the current will be conveyed off into the earth or a reservoir of water, by means of the conductor *a*.

With respect to hydrogen for the purposes of illumination, I have discovered a means of rendering it highly luminiferous, by passing it through spirits of turpentine and other fluid hydrocarbons. The chief matter to be attended to in this part of the operation is, the duration of the passage of the hydrogen, a given time being necessary to the effectual luminiferous or catalysing process. I therefore employ some mechanical means to retard the passage of the current of gas, and to cause it to bubble through the liquid. The method

which I prefer is, to attach cotton wick, or the hollow wick of an Argand burner, or some such substance, to the end of the tube that descends into the turpentine; or to perforate the end of the tube with numerous small holes.

The passage of the gas in this way divides it into minute globules, and consequently brings a greater amount of surface into contact with the hydro-carbon. I have found that when the pipes which lead from the decomposing tank to the hydro-carbon are made of non-conducting materials, or are coated on their interior with sealing-wax or other insulating substance, that the effect is the most brilliant. The hydrogen should, therefore, be conveyed by means of such tubes from the decomposing cells, and passed with all possible speed into the hydro-carbon, after which it may be collected in gasometers or other reservoirs. These latter may also be isolated by position, or by the use of insulating materials; and in practice it may be found highly advantageous to use pipes and tubes of non-conducting materials to convey the gas to the points of consumption. It deserves also to be borne in mind that the vessel containing the turpentine or other hydro-carbon should be of some non-conducting substance, since it appears to be essential to the complete luminiferating or catalysing of the hydrogen that it should come in contact with the hydro-carbon whilst in a highly electrified state. I would observe also, that the height of the column of the hydro-carbon should be nearly equal to that of the column of water around the gasometer, so that the hydrogen shall not pass too rapidly through.

The foregoing description explains a simple and portable form of apparatus, which may be used with or without the governor; but when larger operations are required, the power may be increased either by the use of larger magnets, or by combining the powers of several magnets with a proportionate number of helices. These combinations only require careful mechanical arrangements, directed by practical experience in electric science.

I will now proceed to describe a magneto-electric machine of great power, with which I have experimented very successfully, and which I have called a "Magneto-Electric Decomposer."

Fig. 2 shows a vertical section of a pair of helices in connection with the magnets, and the manner in which the discharge is effected. Fig. 3 is a horizontal section of a pair of helices. Fig. 6 is a view of the lower side of a discharging wheel, with the conducting break at H. Fig. 4 is a vertical, and fig. 5 a horizontal section of a decomposing cell, with the electrodes and platinum termini and radial and converging points. Fig. 1 is a perspective view of the machine. By means of a weight Z, or spring, or other convenient power, I give motion to a train of geared wheels, which, in their turn, cause the helices to revolve between the poles of the magnets. These magnets need not be permanent, but if not, should be inducted before putting the machine in action. The discharging wheels being of much larger diameter than the rings on the spindle head, the helices necessarily revolve several times before a discharge can take place. The electricity is consequently accumulated in the helices, and passes with proportionate intensity at the periodic times. The conducting wires should be of the best conducting material and of large surface, and in operation upon a great scale. I propose to make them tubular, and, if need be, to fill them with water. The cells and spirals are an important part of the arrangement, and in their construction the conditions above mentioned should be well observed. Although I have given this description of the apparatus, I by no means intend to confine myself to any particular form or arrangement. The various purposes for which these machines will be required, will render a great variety of sizes necessary; and the nature and principles of the invention will admit of an equal variety of form and modification.

Throughout the foregoing specification water has been spoken of as being decomposed by the electric currents; but I wish it to be understood that this is merely in accordance with generally received chemical doctrines and phraseology. It may be that water is a simple element; but whether or not, all I wish at present to lay down as certain, is the fact that, by discharging electricity through water in the modes I have described, large quantities of gases are evolved, and that one at least of such gases, so evolved, when passed through spirits of turpentine by the means above explained, becomes highly luminiferous.

What I claim is—

Firstly. The use of helices furnished with hollow helical coils or tubes, to be filled at pleasure with water or other electrical absorbent.

Secondly. The construction and use of electrodes, as above described.

Thirdly. The mode of applying electricity to the decomposition of fluids by pulsations or intermittent discharges.

Fourthly. The mode, construction, and use of governors for regulating the electric currents, as described.

Fifthly. The mode of catalysing or rendering hydrogen gas luminiferous, by passing it through spirits of turpentine or other hydro-carbon at common temperatures.

Sixthly. The use of the non-conducting pipes and isolated gasometers for conveying and receiving the gases for the purposes of this invention.

ON IMPOSSIBLE EQUATIONS. BY ROBERT HARLEY, ESQ., MEMBER OF THE MANCHESTER PHILOSOPHICAL SOCIETY, ETC.

(Continued from page 67.)

[*Note by Mr.* COCKLE.—" By his judicious use of the symbol n, Mr. Harley has presented his operations in a very simple form. His process (*sup.* p. 67) for arriving at a rigid symbolical solution of a quadratic is, in principle, the same as that which I gave at pp. 491-12, and 516-17 of vol. xlvi., and at pp. 13-4, &c., of vol. xlvii. of the *Mechanics' Magazine.* And in eliminating a radical from a surd equation, my process (*Mech. Mag.*, vol. xlvii., pp. 135-6 and 331-2) gives results equivalent to those of Mr. Harley. I have, however, intimated (*ib.* p. 332), that my results are not to be received without modification, and I attempted to explain this circumstance at p. 104 of this Magazine. Whether or not Mr. Harley has succeeded in supplying such necessary modification I am not yet prepared to say; but of this I feel convinced, that the subject cannot fail to receive an impetus from the well-directed efforts of so skilful an investigator as that able gentleman evidently is. In the mean time it is gratifying to find a coincidence between Mr. Harley's conclusions and those which I drew at pp. 520-21, of vol. xlix., of the *Mechanics' Magazine.* For, if $2ac+b>0$, then $x-c$ will, when the two values of x are respectively substituted in it, give results with different signs. Consequently, since it is that which has the negative sign which solves (a'), (3) is the solution of (a'). Without going further into this part of the subject, I may inform my readers that, in referring to the pages last cited, they may reject the limitation which I there imposed upon the sign of d, which may be either positive or negative. It may be proper to add here that the symbol $(-1)^2$, of the use of which various instances will be found in my *Notes* on Equations and *Horæ Algebraicæ*, first made known its independent existence and its inherent diversity, both of nature and of origin, from $(+1)^2$, when the erroneous views, which affected the judgment of even the celebrated EMERSON, respecting imaginary quantities began to be cleared up. That independent nature has been recognised by GOMPERTZ, D. F. GREGORY, and PEACOCK. Let me add that, in three distinct instances (at pp. 199-200 of his Solutions to Hutton's *Course*) my late friend, the ever to be remembered DAVIES, has squared a negative quantity, and added it to each side of a quadratic. Were his example always followed whenever the co-efficient of x in a quadratic, it would give a logical precision to the process, and would justify the form commonly given to the square root of the quantity involving x. There is a note on surd equations at p. 202 of that lamented philosopher's work just cited ('Solutions,' etc. Longman, 1840.)

"I am not prepared to give my assent to the reasoning by which, in what follows, Mr. Harley determines the same to be prefixed to the radicals. But I do not think it desirable to interrupt the progress of that able mathematician's paper by introducing any matter of controversy. I consider that all such remarks on Mr. Harley's paper should be deferred until the *whole* has appeared in print. We shall then, I think, be found to have derived an accession to our knowledge.

JAMES COCKLE."]

2, Pump-court, Temple, February 15, 1851.

Continuation of Mr. Harley's Paper.

When $2ac+b=0$, we have, from (4),

$$\sqrt{2ax+b}=0\,;\ \therefore\ x=c.$$

When $2ac+b<0$, the expression $\sqrt{a^2n^2+2ac+b}$ is of the form $\sqrt{a^2n^2+qn^2p-1}$, where p is an integer, and q is a positive quantity. Making $n=-1$, $n^2=1$, &c., this expression becomes, according as p is taken, equal to or greater than unity,

$$\sqrt{a^2+2ac+b} \text{ or } -\sqrt{a^2+2ac+b}.$$

Hence, if $p=1$, $x=a+c-\sqrt{a^2+2ac+b}\ldots\ldots$ (5),

if $p>1$, $x=a+c+\sqrt{a^2+2ac+b}\ldots\ldots$ (6).

Now bearing in mind that

$$\because\ 2ac+b<0,\ \therefore\ \sqrt{a^2+2ac+b}<a,$$

we find, from (5) and (6),

$$\sqrt{2ax+b}=a-\sqrt{a^2+2ac+b}\ldots\ldots\ldots\ldots\ldots (7),$$

$$\sqrt{2ax+b}=a+\sqrt{a^2+2ac+b}\ldots\ldots\ldots\ldots\ldots (8),$$

(5) + (7) and (6) + (8) give respectively

$$x+\sqrt{2ax+b}=2a-c-2\sqrt{a^2+2ac+b}\ldots\ldots\ldots (9),$$

$$x+\sqrt{2ax+b}=2a+c+2\sqrt{a^2+2ac+b}\ldots\ldots (10).$$

But, since $\sqrt{a^2+2ac+b}<a$, the right-hand members of these equations are each $>c$, and hence neither (5) nor (6) is a root of (a'). And the acceptance of the expression marked (1) as a root of (a'), involving the acceptance also of the inadmissible equality (2),

$$\sqrt{2ax+b}=an+\sqrt{a^2n^2+2ac+b}=$$

a negative quantity, we finally conclude that, in this case, (a') is an *impossible equation*. (Art. 4.)

These results adapted to equation (a) are as follows:—

When AC + BD is positive,

$$x=\frac{1}{2A^2}(B+4AD-\sqrt{B^2+4ABD+4A^2C})\ldots\ldots (11),$$

is the root of (a).

When AC + BD = 0, $x=\dfrac{D}{A}$ is its root $\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$ (12).

When AC + BD is negative, (a) is impossible.

The root in terms of n is

$$x=\frac{1}{2A^2}(Bn^2+2AD+n\sqrt{B^2n^2+4ABD+4B^2C})\ldots\ldots\ldots (13).$$

We next proceed to consider the congeners of (a), (a'); viz.—

$$Ax-\sqrt{Bx+C}=D\ldots\ldots (\beta)$$

$$x-\sqrt{2ax+b}=C\ldots\ldots (\beta')$$

7. These equations are readily deduced from (a), (a') by substituting Bn^2, Cn^2, an^2, bn^2 for B, C, a, b respectively; and hence making these substitutions in (13), (1), we obtain for the respective roots of (β), (β'):—

$$x=\frac{1}{2A^2}(Bn^4+2AD+n^2\sqrt{B^2n^4+4ABD+4A^2C})\ldots\ldots (14),$$

$$x=an^4+C+n^2\sqrt{a^2\ \ \ \ 2c+b}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (15).$$

Adopting a line of argument similar to that pursued in the discussion of equations (a), $(a'$ we arrive at the following conclusions:—

When AC + BD or $2ac+b$ is positive,

$$x=\frac{1}{2A^2}(B+2AD+\sqrt{B^2+4ABD+4A^2C})\ldots\ldots (16).$$

or, $$x=a+c+\sqrt{a^2+2ac+b}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (17).$$

When AC + BD = 0, or $2ac+b=0$,

$$x=\frac{D}{A}\ldots\ldots (18) \text{ or } x=c\ldots\ldots (19).$$

When AC + BD, or $2\,ae + b$ is negative,

$$x = \frac{1}{2\,A^2}\,(B + 2\,AD \pm \sqrt{B^2 + 4\,ABD + 4\,A^2C}) \ldots\ldots (20).$$

or, $$x = a + e \pm \sqrt{a^2 + 2\,ae + b} \ldots\ldots (21).$$

where the double sign ($\pm$) indicates *two roots*. It hence appears that every equation of the form (β) or (β') has at least *one root*.

(*To be continued.*)

AMERICAN TRANSATLANTIC STEAMERS.

(From the *New York Tribune*.)

When it was first announced that an American steamer had crossed the Atlantic ocean in some hours less time than a rival steamer of a British line, I heartily joined in a feeling of rejoicing quite natural on this side of the water. Subsequent voyages, however, dissipated our expectation that the superiority once manifested would be of a permanent character. That it should not be incontestably so is the more grievous and astonishing, as the American steamers have over the rival line an incontestable and very great advantage in the power of their machinery. The *Atlantic*, the *Pacific*, and the *Arctic* are possessed each of a joint steam power of 2,000 horses, the pair of engines in the Cunard steamers ranking only from 800 to 900 horses. The *Baltic* has two engines, of the enormous joint force of 2,200 nominal horse-power. It is easier to conceive how extraordinary such an amount of power is, by reflecting that it is equal to the average strength, in labour, of 3,300 real horses, or to work to be performed by nearly 10,000 horses during the 24 hours of every day, or, finally, to an army of 70,000 oarsmen! Larger steamers have existed, but none, as far as I know, of so immense a power. And yet this display of a gigantic industry has no corresponding effect. The speed of this ship has hitherto proved inferior to the speed of steamers of her rank in burden, although driven by scarcely more than one-third of her power. Further trials will most probably prove less unfavourable to her; but I am much afraid that neither she nor her Leviathan sisters will ever win the lasting and unquestionable pre-eminence they are entitled to, unless a considerable deviation from the rules of a sound theory, which is to be observed in a part of mechanism is corrected. In what that deviation consists, and what the remedy should be, I shall respectfully suggest, as by chance it may not have been already perceived or suggested by others.

First of all, it will be to the purpose to compare the dimensions of the *Baltic* and one of the Cunard steamers (the *Asia*), as they are laid down in the draughts published by Currier, 132, Nassau-street:—

	Baltic.		Asia.	
Length on deck.........	282½	feet.	280	feet.
Breadth of beam.......	45	,,	38	,,
Across paddles	75½	,,	67	,,
Depth of hold............	32¼	,,	27	,,
Diameter of wheels ...	36	,,	36	,,
Burden......................	2,723	tons.	2,226	tons.
Horse power, 2 engines.	1,100	each.	400	each.

Every one will be struck by the fact that, there being between the two rival steamers so moderate a difference in dimensions, there should be so great a difference in the horse-power (not less than 2,200 to 800). This circumstance would have led many to anticipate that the *Baltic* would not fail to beat the *Asia* by many days in crossing the ocean. If a mathematician had dared to foretell that, on the contrary, the *Baltic* would scarcely equal the *Asia* in velocity, both he and his theory would have been laughed at. Generally, however, Experience herself takes care to revenge the honour of her learned daughter and guide, Theory; and such has been the case on this occasion. Let us seek for the reasons.

We must first bring to our recollection that, other things being equal, the quantity of power necessary to obtain a given velocity in a fluid is proportional, not simply to the velocity itself, but to its cube. A double velocity requires an eight times greater power; a triple velocity, a power twenty-seven times greater. Were the immersed amidship sections of the *Baltic* and *Asia* equal, and their machinery equally perfect, the former would yet have no greater speed than 15½ miles per hour, when the *Asia* would have 11. But as both are nearly of the same length, the *Baltic*, whose burden is greater, must have a breadth and depth of immersion absolutely and relatively greater than the other; but the depth which would singly answer to the weight of the hull and of the useful burden is very much increased by the weight of the engines and coal. As a steam engine cannot consume less than 5lbs. of coal per horse an hour, the *Baltic* must consume in a single hour not less than

11,000 lbs. of coal; and whereas the rules of the most ordinary prudence must require her always to take in a store of fuel for fifteen days at least, it makes the vast load of 1,800 tons of coal. How much is the weight of the engines I do not know, but it is certainly enormous; from indications privately obtained I should judge it is not inferior to the whole weight of the coal. Consequently, a very considerable part, perhaps more than a half, of the whole power of the engines is employed in nothing else but in carrying themselves and their supply of fuel.

Be this as it may, the breadth of the two steamers we are comparing being respectively 45 and 38, and the depths of hold 32½ and 27, if we subtract about 12 feet as an allowance for the necessary elevation of the upper deck above the water, and add something to the depth of the *Baltic* for the necessary greater thickness of the bottom, we may well suppose that the height and width of the immersed midship sections of both steamers are respectively 45 by 24, and 38 by 17; therefore the resistance of the sea to the steamers' progress, the velocities being equal, would be nearly in the ratio of 1,080 : 646. Consequently, to obtain the same speed, the force of the *Asia* being 800 horses, that of the *Baltic* should be, proportionately to the sections, 1,337,—but it is 2,200; then, were steam applied to equal advantage in both ships, their respective velocity would be in the ratio of the cubic roots of 1,337 and 2,200, which are nearly 5·113 and 6·037. That is to say, if the average passage of the *Asia* be reckoned at twelve days, that of the *Baltic* should be only ten. Now, this is not the case. In good weather, of course, she will have shorter average passages than the two last, but the *Asia* also will then make shorter voyages. There must be, therefore, a reason why the *Baltic* and her fellow steamers of the American line cannot have that full advantage of nearly two days which belongs to the proportion of their steam power to their resistant transverse sections.

The main reason lies in the comparative smallness of the paddle-wheels. To prove this I am obliged to demonstrate a general theorem—namely, that the larger the working surface of the paddles the greater the vessel's velocity must be, the quantity of steam employed being the same. Let A be the reduced surface of the paddles, by which I mean the hypothetic surface of a single paddle, which, beating perpendicularly the water with the velocity proper to the actual inferior paddle, would give an effect equivalent to the joint effect of the several paddles partially or totally immersed with different inclinations.

The pressure which this reduced surface exercises backward against the water by its revolutions is in the compound ratio of A itself, and of the square of its absolute negative or backward velocity, a velocity which we call u, as we shall call v the steamer's velocity. Let b, c, d, e, &c., be constant co-efficients: The resistance of the sea to the advance of the steamer is proportional to the square v of her velocity. By the fundamental principles of dynamics, when v is uniform, this resistance must be equal to the pressure exercised by water in the contrary direction against the paddles by virtue of their backward motion; we shall have, therefore, $v^2 = b A u^2$.

Here it appears that we may augment the ship's velocity V either by increasing A or u; we could do both were the power of the engines indefinite; such not being the case, we cannot augment either of the quantities A u without diminishing the other. Now, by augmenting A we have an advantage much superior to the disadvantage arising from the obliged diminution of u. Let us call C the quantity of steam constantly expended by the engines in an unit of time; this quantity is in the composed ratio of the density of steam in the cylinders, and of the number of strokes in the unit of time. But the density of the steam is proportional to the pressure upon the surface of the pistons, and this pressure must be in a constant ratio with the pressure A u^2 of the paddles moved by the pistons; and the number of strokes of the latter in the unit of time being equal to twice the number of revolutions of the paddles, must also be proportional to the velocity of the revolutions of the paddles, which is $u + v$. Therefore, $C = d A u^2 (u + v)$.

If the valor of A, taken from this equation, be substituted in the former, we shall have

$$v = \frac{d C}{u + v}.$$

Here it is visible that a and C being constant quantities, the smaller u is, the greater will v be—namely, to have the greatest speed of the steamer we must give to the backward motion of the paddles the least possible velocity. It appears, however, from the second equation, that we cannot decrease u without increasing A; to wit, we must supply by an augmentation of the surface of the paddles their diminished velocity.

To translate mathematical demonstrations into language intelligible to all, and still absolutely conclusive, is not an easy task. I may, nevertheless, entreat those of my readers who may happen to be little conversant with algebraical calculations to represent to themselves, in the room of the actual pad-

dles of the *Baltic*, two other paddle-wheels of the same diameter, but wider, and therefore with larger blades than the present ones. To find an equal backward resistance in the water, the new paddles, on account of the great surface, do not want so great a velocity as the former. Now, as the pressure exercised, either by the new or old paddle, is by supposition the same, the required tension or density of steam in the cylinders will also be the same in either case. As, however, the new paddles revolve more slowly than the old ones, the pistons also will make in a given time a less number of strokes, and the vessel consume less steam and coal. So with wider paddles the *Baltic* could consume less coal than she does, and still go at the same velocity. This being once granted, it will then be easily admitted, too, that if the *Baltic* should employ with the new wider paddles the same quantity of coal, she would necessarily acquire a greater speed. It will also be easily understood, that instead of making the paddles simply larger in width, there will be an advantage in making them longer also, and increasing proportionately the diameter of the wheels.

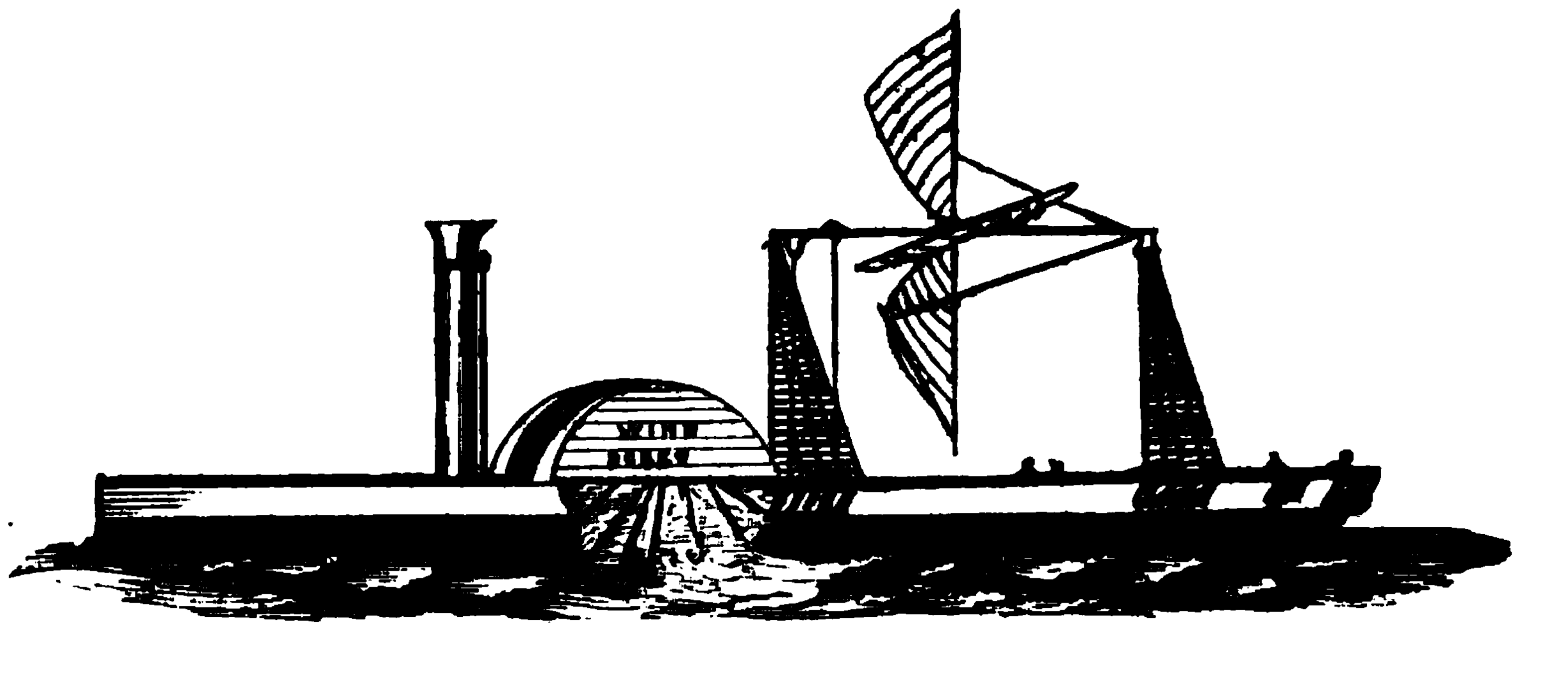
With the mass of people, the best and most abstract reasoning has seldom any practical effect unless it is supported by some obvious fact. Fortunately there is a capital fact at hand. Let us look again at the dimensions of the *Baltic* and *Asia*. The breadth of beam of the former is 45 feet, and across paddles 75½. This shows the paddle-wheels to be of the joint breadth of 30½ feet, or 15¼ each. A like calculation for the *Asia* will show her paddles to have a breadth of 14½ feet each; only nine inches less than the former. The diameter of wheels in both cases is exactly the same, 36 feet. It may then be said that the paddles of both steamers are very nearly equal. So it is with the other steamers of the Collins' line. Is not this a singular fact? The power setting the *Asia* in motion is 800, the power working the others is 2,200, and still the organ of locomotion is the same. Either the dimensions of the *Baltic* or of the *Asia* are wrong. Theory unhesitatingly would have settled the question in favour of the *Asia*, even before seeing both at work. Practical men would not decide so promptly. But here is the fact that the *Asia*, capable of carrying a cargo little short of that of the *Baltic*, and with only 800 horses, is faster than the latter with 2,200 horses. I hope, then, that even mere business men will readily acknowledge that, of the two, it is the *Baltic* which has paddle-wheels of improper dimensions.

It is to be desired that they should be removed for larger ones. How much larger? The larger the better; but let them bear to the moving power at least the same relation as in *Asia*. To make them so, they should have a radius of 30 feet instead of 18, as they now have.

This, of course, would require other alterations. If the engines are capable of safely enduring a greater pressure in the ratio of the increased length of the time of a revolution of the wheels—which I think very likely to be the case—the cylinders need not be changed; if not, others might be made whose capacity shall bear to the capacity of the present cylinders the same ratio as the time of revolution of the new wheels to that of the old ones. The increasing of the diameter of the wheels, besides the corresponding augmentation of surface in the paddles, will have another advantage, by partially obviating an inconvenience of which I have not yet spoken. It is known that a considerable part of the effort necessary to move the paddles immersed in water is lost because of the obliquity of their action through the greater part of their movement in the water. How much this defect is compensated by having a greater number of paddles, depends upon the degree of immersion. Now, as the great consumption of coal must cause the waterline to vary considerably during the voyage, if the arc of immersion of the paddles be the best possible at any one time, it must be very unfavourable either at the beginning or towards the close of the voyage; and this cause is also a drawback in the useful effect of the power employed. This inconvenience, however, must be much less sensible in the British than in the American steamers, as the load of coal in the former is in proportion very considerably smaller; but it will also be reduced in the American steamers by the simple enlargement of the diameter of the wheels. It would be reduced to a much more considerable extent by making the axle capable of being raised or lowered upon screws with a corresponding extensibility in the connecting rods. Such a correction, which is wanted nowhere to so great a degree as in the American Transatlantic steamers, if adopted by them, would indirectly benefit future steamers even not adopting it, by furnishing the easiest and surest manner of testing by experience what is practically the best arc of immersion for paddle-wheels.

I am very greatly mistaken if, by such simple and easy improvements, these magnificent and powerful specimens of modern art would not gain the end for which immense sums have been and are so liberally expended upon them—that of bringing two worlds nearer to each other, not only by a few hours, but by whole days. At any rate, let the candid exposition of my opinion not be considered as a presumptuous obtrusion, but as a token of the deep interest I have, with millions of other people, in the subject.

WIND SCREW FOR THE PROPULSION OF VESSELS ON THE RIVERS OF INDIA.



Khairda-Nulla, Jan. 10, 1851.

Sir,—There appeared in your Magazine, some months ago, some very able hints on the application of manual labour to the propulsion of ships (men of war in particular), in cases of calms, dangerous currents, or coming into action. The difficulty, however, appears to be the manner of causing manual power to act on the water, as the screw and paddle-wheel, the almost universal mediums of propulsion, are not capable of being rigged and put into use on a sudden emergency.

The idea has struck me, that such power might be almost immediately brought into play by the medium of what I shall take the liberty of calling a "Wind Screw," *i. e.*, an apparatus like a propelling screw, or a windmill sail, moved by a multiplying wheel from the capstan, or otherwise, and acting on the air in a calm, or on the breeze in very light airs.

So far I have spoken of the subject only with regard to general navigation; but there is a particular case in which this plan might, I am sure, be tried with the most beneficial results. I allude to the navigation of the Indian rivers. The usual character of these streams you are doubtless acquainted with; viz., their rapid currents and shallow water: but there is another, which I would particularly allude to—the fact that the wind almost invariably blows strongly up stream. Now a steam-vessel ascending the Ganges or Indus, has at certain places to get up a speed of six or eight miles an hour to hinder her absolutely losing ground; so that to propel her forward at any pace, the engine must acquire a velocity that can on no account be desirable,—whereas the same engine, acting on the air by means of a "wind screw," would play on an element, giving a hold to the propeller, greater by six or eight miles an hour in a calm, than the paddles can have on the water; and with the favourable wind above alluded to, an enormous power might be exerted, without the engine working up to an unfavourable speed. The other great difficulty which exists in steam navigation for Indian rivers, is the want, not of the propeller, but a hold of more than a foot in the water, and this would, of course, not influence a "wind screw." The latter, with its sails furled, would present no greater obstacle than any other kind of rigging; and, in these days of rotary engines, where a piston without dead points is procurable in as little space as is occupied by a lady's band-box, I presume no difficulty need occur in any steamer in working the "wind screw" at the same time as the paddles, though independent of them with regard to speed.

I am, Sir, yours, &c.,

B. H. K.

THE LATE FIRES AND FIREPROOF PARTITIONS.

The late conflagrations, of warehouses in Little Britain, and in Duke-street, Tooley-street, afford additional proof that the generality of buildings are ill-adapted to prevent the spread of fire, and that the water-works in the metropolis are but ill-calculated to its extinguishment. In the former instance, iron doors between divisions of the warehouse, prevented the fire-brigade from passing with their hose, to parts not at first ignited, and which, probably, would have been saved, had the firemen not been impeded by the doors. The immense warehouses in Duke-street were not so divided—so that fire having broken out, the contents of the whole floor were speedily in flames, and floor after floor was speedily ignited, till the fire was arrested by the concrete flooring over the ground storey.

The preservation of the ground-floor, and of the cellars under it, affords a useful example of the resistance of concrete to fire; but the immense weight of this composition, when of sufficient thickness, is a great drawback to its utility as flooring. Long ago, a mixture of reeds was used to diminish the weight; and at Belper, fifty years ago, a floor was constructed of hollow bricks, built in and covered with mortar, in the form of a flat arch, supported on iron columns.* The building was for a cotton-mill, consequently has had to withstand the jars and vibrations occasioned by the machinery with which its floors have been covered: it would be of practical use to ascertain now, how those floors have stood after so long a trial, since a combination of lightness with strength, in addition to slow conduction of heat, are as important in the construction of warehouses as of manufactories.

Lime mortar, like concrete, resists flame and heat much more than is usually supposed. Amongst the experiments Sir Samuel Bentham was carrying on at Portsmouth, was one that gave a result more important than could have been expected. Over a forge fire in the metal mills he caused a hood to be constructed of deal boards, nailed to a timber framing, and the interior of the hood was plastered with good common lime mortar, made to adhere to the wood by short iron nails driven into it. The forge was long in constant use,—flames at times ascending nearly to the hood, and sparks continually striking against it,—yet no part of the wood was ever charred, or as much as discoloured by heat. Of course, no lime cement could resist heat sufficiently to re-burn the calcareous part of the composition into lime. The floor lately submitted to so great a heat in Duke-street should be carefully and chemically examined, to ascertain the state of the concrete after its exposure to so violent a conflagration.

No. 1355 of this Magazine contains suggestions for the prevention and spread of fire in the proposed Record-office, many of which seem applicable to great warehouses and other extensive buildings—one in particular; that their several compartments should have no *internal* communication one with the other, and that there should be no *internal* air-funnels, such as staircases; but that communication with the several floors and compartments should be by *external* galleries, and *external* stairs.

Where ground is of so high value as it is in the mercantile parts of the metropolis, external galleries might be grudged on account of the ground space they would occupy, but, in point of fact, no more would be required for an external communication than for one within the walls. Indeed, there would be no real inconvenience were such galleries to project over a footway, though by the Building Act they are inadmissible; the Piazzas of Covent-garden are examples of accommodation to pedestrians afforded by a covered way; such galleries, too, might be made to relieve the walls of a building from the ponderous encumbrances of cranes, and passengers below from the inconvenience and danger occasioned by hoisting up heavy goods over the footway. In case of fire, such galleries would afford unexampled facilities for its extinguishment, as, instead of climbing over the roofs of houses, firemen with their hose would be enabled to place themselves at once close to any compartment where their operations might be requisite.

* On the plan, we believe, of the late celebrated Dr. Cartwright, and patented by him in 1797.—Ed. M. M.

Probably before another half century shall have elapsed, Sir Samuel Bentham's arrangements for the extinguishment of fire will be very generally adopted in the metropolis. Some account of them appeared in Nos. 1268 and 1369 of this Magazine; they have been partially had recourse to in some private manufactories and at the British Museum; and Sir Samuel's fire-extinguishing works at Portsmouth were visited previously to the introduction of those exactly similar ones. Latterly the press has taken up the subject—*Household Words* some time ago, the *Illustrated News* of the 22nd ult.; but it is somewhat mortifying that no allusion is ever made to Sir Samuel, though it was so long ago as 1797 that he officially proposed the water and fire-extinguishing works at Portsmouth, carried them into execution there, and shortly afterwards at Plymouth and Chatham; proposed them for Sheerness in 1812; communicated to Sir Robert Peel in 1830 a plan for rendering the water-works of the metropolis competent to the extinguishment of conflagrations in it (in the same way as those he introduced at Portsmouth have on many occasions proved perfectly efficient), and that his plan for the metropolis was, after his decease, submitted to Lord Lincoln in the year 1844.

M. S. B.

CHEVALIER CLAUSSEN'S FLAX PROCESS.

At the Weekly Council Meeting of the Royal Agricultural Society, on the 25th of February last, Mr. B. Browne, of Hampen, near Andoversford, Gloucestershire, favoured the Council with the result of his experience in the growth of flax. He had been one of the first members of the Society to call the attention of farmers to the cultivation of flax, which he believed to be a paying crop; and having become acquainted with what had been done in Belgium and Ireland, he had for the last seven years devoted his attention to the conditions under which the growth and management of flax in this country might be carried on in the most economical and successful manner. Mr. Browne thought it would be well for the public generally, as well as for the owners, and tenant-farmers more especially, to come to no hasty conclusion on any of the new systems of flax management proposed for their adoption, however plausible such systems may on their first presentation appear to them; but in this pursuit, as in that of higher objects, "to prove all things," and only "hold fast that which is good." The separation of the seed capsules from the stalk, the woody part from the flax fibre, the flax fibre from the glutinous matter, and also the flax fibres themselves from each other, were all important practical objects, for the attainment of which various modes had been proposed, differing from each in efficiency, economy, and the circumstance of greater or less injury, or otherwise, to the flax fibre for manufacturing purposes. Mr. Browne preferred the hot-water system of steeping to any of the former modes, as it was not only the cheapest, but fell in with the regular routine of business, summer and winter, and could be carried on by the same hands. The removal of the woody part from the flax fibre, by chemical means was easy to be accomplished, and had long ago been effected by Professor Faraday; but in no case, that Mr. Browne was aware of, in which the flax fibre did not suffer injury from such chemical means, and become weak and rotten. Whatever M. Claussen's plan might then be, he feared that he had yet to surmount that difficulty, by employing only such chemical agents as will effect the separation required without injuring the strength of the flax fibre or the yarn into which it is spun. To assure himself of the quality of M. Claussen's yarns, he had sent for a sample to the mill at Rochdale, where M. Claussen's processes are carried on; and this yarn, which he then exhibited to the members, along with a specimen of cloth woven from it, would be found deficient in the strength required, and inferior to that possessed by the ordinary cotton yarns. Mr. Browne remarked, that in mixing flax and cotton together, it was necessary to cut the flax fibre short, and by chemical means nearly to destroy that fibre before it is sufficiently tender to mix with cotton; and then, with the same sized yarn, there would accordingly be nearly two parts of cotton to one of flax in any cloth manufactured from flax-cotton, as the flax it contained would be about as heavy again as the cotton. He therefore conceived that, as all cloth is sold by weight, the saving would not be so much an object gained by this mixed fabric. He also thought that M. Claussen's manufactured specimen should be examined in cloth, like calico or linen, not in ribbed fabrics like stockings, which afforded no test of excellence. Mr. Browne and a friend of his had succeeded in their attempts to separate the fibres of flax from each other to such a degree as to confer on the flax the character and qualities of cotton; but by all the processes they

had tried, the flax fibre had become weakened and rotten. They found that No. 16 thread, one-half foreign cotton with one-half British cotton, 120 yards long, weighed 83 grains; No. 16 thread, all foreign cotton, 120 yards long, weighed 56 grains; and therefore concluded that it would take one-third more of flax-cotton mixture to make the same surface of cloth, and to make it badly, than of foreign cotton alone. The cloth woven from No. 16 thread, one-half foreign cotton and one-half British cotton, had the appearance of the cloth employed for sieves and strainers. He made these remarks in perfect sincerity, and with no other motive than that of obtaining the truth, and of wishing it to prevail; for should M. Claussen's plan, when perfected, prove to be a better one than the hot-water system he had himself adopted, he would not hesitate to lay that system aside, and try to get from M. Claussen a license for the use of his patent, and its introduction into his own establishment a Hampen.

The Chevalier Claussen presented himself before the Council, to lay before the members a statement of his process for converting flax into a substance having similar properties to cotton for manufacturing purposes, and for improvements in the bleaching of vegetable productions and of textile fabrics composed of such productions. M. Claussen having laid on the table a copy of the "Specification"* at length of these patented processes, requested Dr. Ryan to explain for him to the Council the nature and bearing of the processes in question.

Dr. Ryan stated that, although flax fibre in its usual state was specifically heavier than cotton, yet, when prepared by the Chevalier Claussen's plan, it became exactly of the same gravity as American cotton. The process of preparing the straw for scutching only occupied four hours, instead of five days—the shortest period under even the patent of the late Mr. Schenck, the one now patronised by the Royal Flax Society of Ireland. M. Claussen merely employed soda and sulphuric acid, and these in such a form and in such quantities as not to injure the most delicate fabric. Thus the proportion of soda was only 1 part in 200 parts of water. The acid was added after the straw had been boiled with the soda; and the objections to the employment of such a substance would be overcome by remarking that the proportion of the acid was only 1 to 500 of water, and that the soda present in the straw neutralizes the whole of the acid, and forms a neutral salt—sulphate of soda. In the next place, Dr. Ryan explained the process of cottonising the flax, or in other words, of splitting its fibre, and converting it into a material which could scarcely be distinguished from the finest American cotton. This he considered the most useful portion of the discovery, opening, as it did, a new market to the flax grower, and enabling the manufacturer to spin it on any machinery hitherto employed for cotton, silk, or wool. Dr. Ryan then detailed the process itself, pointing out the elastic force of the carbonic acid gas liberated in the tubes of the flax fibre by the action of an acid on the carbonate of soda, or of potash. He also stated that he came prepared to show to the Meeting practically, by experiment, the processes of splitting and of bleaching—experiments which would render the matter intelligible to everyone present.

Dr. Ryan now handed to Mr. Way, the consulting chemist to the Society, a copy of M. Claussen's specification; and in a few moments that gentleman returned to the Council-room, and remarked that he had just himself tried the experiments according to the directions of the inventor, and had perfectly succeeded in splitting and bleaching some flax fibre. It was therefore suggested to the Chairman by Dr. Ryan that, as Professor Way was a perfectly disinterested party, it would be better for him to operate before the Meeting. This Professor Way did most successfully, bleaching and splitting a quantity of flax in the course of about two minutes. The flax fibre soaked in the solution of subcarbonate of soda was no sooner immersed in the vessel containing the acidulated water, than its character became at once changed from that of a damp rigid aggregation of flax to a light expansive mass of cottony texture, increasing in size like leavening dough, or an expanding sponge. The change was no less striking when this converted mass in its turn was placed in the next vessel, which contained the hypo-chlorite of magnesia, and became at once bleached, attaining then the colour, as it had just before received the texture, of cotton.—*From the Daily News Report.*

* For this see *Mech. Mag.*, No. 1439.

BRICK-MAKING AT ROORKEE.

The *Delhi Gazette* publishes a report by Lieutenant-colonel Cantley, on the different machines used in making bricks for the great works at Roorkee. About one hundred million of bricks, or a 1,000 lakhs. were required for those gigantic works at Roorkee, to be made at the rate of 170 lakhs a year. The great difficulty in obtaining these bricks arose from the perverseness of the men employed

to mould the clay into the proper shape. The brick-making season in the North West, extends from the 1st October to the 15th June, and supposing each man to turn out 800 bricks a day, 105 brick moulders would be required to complete the number annually required. There existed great difficulties, particularly on the score of expense, in collecting and maintaining so large a number of skilled workmen, and when collected, they were found to be extremely difficult to manage. The slightest reproof to one of their number was sufficient to induce the whole body to march off the field with their moulds, and in one instance they played this trick twice in a single week.

Colonel Cantley while in England endeavoured to procure machinery which would obviate the difficulty, and finally selected a machine commonly called Ainslie's Machine, which was highly recommended by practical men. It was not, however, found to answer in this country, as the bricks were all torn at the edges and broader at the bottom than the top. Another attempt was therefore made by Colonel Cantley, with a machine which he had observed at the agricultural meeting in Northampton, and which bore the name of "Hall's Patent." This machine had been patented for England by Mr. Ransome,* the eminent Ipswich iron-founder, and a member of the firm whose colossal instruments for observations are so highly extolled by Sir F. Head. One of these machines was brought out, and placed under the superintendence of Mr. Finn, the executive officer of materials at Roorkee. It succeeded admirably, and turned out every day upwards of 10,000 perfect bricks,—thus performing the work of twelve brick-moulders. The establishment required for bringing the clay and working and performing all the other labours necessary to the turning out of 10,000 bricks per day, is thus stated: Eleven excavated the clay and carried it to the pug-mill cistern, average distance 130 feet; two supplied the cistern with water, and cleared up the drying ground; three filled the pug-mill from the contents of the cistern; one cleaned and sanded the moulds preparatory to passing them into the machine; one served the machine with empty brick-moulds; one on the wheel pressed the mixed clay into the moulds; one on the lever forced out the mould; one on the mister or strike, cleaned the top of the bricks, and raised the moulds to the heads of the carriers; six carried the loaded moulds from the machine to the drying-ground; one relieved the carriers of the moulds and placed the bricks in regular lines on the drying-ground.—Total 28 bilders. Each of these men received six rupees a month—and the total cost of wages is, therefore, less than five Rupees and-a-half a day. As soon as the brick-moulders found that their employers could dispense with their services, with true native instinct they became tractable and active, and whereas they were accustomed to turn out only 800 bricks a day each, and sometimes less than that number, they now turn out 900 perfect bricks in the same time. Nor is the saving of expense less remarkable than the increase of productive power. The original price of each machine in England was Rs. 960, and the total cost on its arrival at Roorkee Rs. 1,561; but Colonel Cantley has succeeded in making the machines in Roorkee itself for Rs. 500. With these machines the price of a lakh of bricks is Rs. 54—1. On a large scale 976,016 bricks were made for 670 Rupees. We are unfortunately not informed of the exact expense of making bricks by hand under the old system at that station, but we know that in Bengal they cannot be made under Rs. 150 a lakh, and in many places the expense is considerably greater. The Government save therefore at least Rs. 90 per lakh, or nearly a lakh of rupees in this single undertaking at Roorkee, and this by the employment of European machinery, the most expensive of all English manufactures. Any enterprising individual who would construct and work a few of these machines in Bengal, would bring down the price of bricks, to the great benefit of the public, and not less perhaps of himself. The selling price within 60 miles of Calcutta, is at this moment from Rs. 400 to Rs. 450 per lakh.—(*The Friend of India*, of December 12, 1850.)

* Messrs. Ransome and Parsons, Patent Stone Works, Ipswich, were the manufacturers of this machine, and are the proprietors of the patent.

RIVER WATER.

The more I consider the question of the supply of water to towns the more I am convinced that *river* water should be repudiated, and that its wholesomeness in reference to the animal economy, has far more to do with its *organic* matter than its comparative softness or hardness, as to its inorganic chemical composition. Even if bad water did not *originate* endemic diseases, there can be no doubt that it seriously aggravates them: that noxious water predisposes the system to the invasion of epidemic disease, I cannot doubt. River water is especially fraught with organic life, such as monoculi, the entozoa, and among infusoria, the vibrio and volvox. I need not, however, particularize, for their name is legion. The

water of the Thames, Hull, and Nith have all been proved, beyond contradiction, to have fearfully aggravated the cholera in 1849, and the Tyne, at Newcastle, in 1832. The chief sources of these organisms are the sewers that empty themselves into these rivers. Though the existence of these microscopic animalculæ are not doubted, and cannot be denied, it has been questioned whether their action is *injurious*: for my own part, I can have no doubt about the matter; I only wonder there should be any scepticism on the subject. No one doubts that stagnant water is injurious, nor would any person affirm that the bad water of the pestilential swamps of Walcheren, where the teeth were in constant requisition as a strainer, did not materially aggravate the type of that fatal fever. It is also admitted that *decomposing* organic matter is found in every river, but it has been said that the quantity is too small to be injurious! Too small!—where are we to look for the graduated metre of injury? This is egregious trifling in a very serious question. According to Ehrenberg, invisible animalculæ cause the death of fish in their own element; and, without stopping to inquire whether, as Müller conjectures, they may yet be discovered in the human intestines, their presence may unduly excite or irritate the alimentary canal, and prove seriously injurious or destructive to health. Thus may they act as a predisposing cause to febrile attack on the invasion of the system by cholera.

Facts innumerable bear testimony to the truth of these positions. Horses and cattle are always seriously affected, as well as strangers, at Inverness, in drinking the water of the River Ness. The troops were affected with dysentery by drinking the water of the River Lee at Cork; and in the trial *versus* Hall, of Basford, at Nottingham, it was proved in evidence that the cattle perished of dysentery by drinking water fraught with organic matter. More facts might be supplied, if more were necessary, to substantiate the well-grounded assumption, that river water is most injurious to health from its impregnation with organic matter, arising from sewers and other impure sources. It is the same with any water if imbued with organisms, either animal or vegetable, but above all, the former.—*Professor Murray.* (*Mining Journal.*)

CONCRETE COCOA-NUT OIL.

Sir,—I have been given to understand that, at Constantinople, the solid or concrete oil of the cocoa-nut is rendered permanently liquid at ordinary temperatures by some very simple process, and is then used for lubricating all kinds of machinery, and likewise for burning in lamps.

Perhaps some of your readers in the east may be in possession of this process; if so, its communication, through the medium of your pages, would greatly oblige

Your constant reader,
RICHARD JACKSON.

Feb. 25, 1851.

WHAT IS YET TO BE DONE BY THE ARTS.

The faculties of those who talk of limits to knowledge, and to the fruits of knowledge, are nascent. They have neither full nor half-grown ideas of man's power and the miracles in agriculture, chemistry and mechanics he has to perform. Would they judge of the future by the past, or determine what is to be, by what is? So they think the earth is to remain as now—the greater part arid moors, dark forests, and morass! A larger, much larger, proportion of their own species, too, as destitute of mental and moral cultivation! Why, man is only entering on his task—by a few preliminary and scattered experiments preparing himself to set about it. An infinity of work is before him. As an agriculturist he has to lay, and keep enlarging, the basis of the social column. All but an insignificant portion of his splendid patrimony is yet wild land; this he has to reclaim and convert into orchards and gardens, into grass and grain-growing fields. The richest sections,—the tropics, so exuberant in fertility, are to be subjugated; hardly touched by the plough, though deemed the birthplace and special homestead of the species. Free and facile communications with and through all have to be established. Add to this the purification of the atmosphere from malaria—for by human providence, salubrity is to succeed the baneful miasma of marshes; the hot-bed of fevers and agues are to be dried up, and human life and life's happiness prolonged.

The nature and properties of myriods of unknown plants have to be ascertained—the valuable fostered, improved, and multiplied: the noxious and useless suppressed. So of animals—for to us is committed the power of moulding and multiplying such as are serviceable, and of annihilating others, by removing the conditions under or by which they alone can exist. By the exercise of this prerogative, results have been brought about as singular as any in vegetable and artificial organisms, dimensions, forms, colours, proprotions, habits, tastes, and the very faculties

of the lower tribes, have been changed—so much so as to make it doubtful whether species and subspecies may not be due, after all, to this strange plasticity of animated nature. The earth is a laboratory, in which as a chemist man has hardly begun to operate. A few loose samples of what it is composed have been partially analyzed, but the bulk is not yet broken into. Then the infinity of processes ceaselessly and silently going on in organized and inert matter has to be grapelled with. As a factory, too, furnished with implements and materials in superabundance, little has been done in it—nothing worth naming, in view of what has to be done. The rich stock has been neglected —not half of it has been yet even seen—while forces for fabricating it have from the beginning of time been, some running to waste, others lying dormant for want of being called up to labour.

When every force, latent and manifest, is brought into service and made the most of, when man has spread his influence over every foot of the earth's surface, and brought the stores beneath it within his reach—when mundane matter, in whatever form appearing, is made to contribute to his ends—when the planet is wholly changed from its natural wildness as a harbour for untamed brutes and noxious reptiles into a fit theatre for cultivated intelligences—it will be time enough to speak of human advancement as culminating, and the arts as approaching the limits of perfection.

Till these things come to pass, instead of looking for no more discoveries, we should be prepared for a constant succession of them. Prepared or not, they are sure to come; for hosts of keen intellects—interrogating Nature in our own country, and the legions as busy in others—are not entreating her for nothing, nor for trifles.

Civilization may be likened to a statue, the carving of which is the business of the species. It includes all duties, and furnishes appropriate employments for the varied capacities of all men for all time. Each successive age withdraws one band of labourers, and brings forward another, whose faithfulness, awkwardness, or negligence advances or retrogrades the work. Under barbarism, it was a shapeless block; with the dawn of knowledge, its features began to appear, and then nations occupied themselves in chiselling away superfluous materials, and bringing them into higher relief. During the last century some artist-like touches were added —more have been in the present one; and in the next, this great moral sculpture will be further improved: for the time can never be when to it new graces and a higher polish cannot be given. To those who add nothing to it, existence is a blank.—*Report of Wm. Ewbank, Esq., American Commissioner of Patents.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MARCH 8, 1851.

RICHARD PROSSER, of Birmingham civil engineer. *For improvements in supplying steam boilers with water, and in clearing out the tubes of steam boilers.* Patent dated August 22, 1850.

Mr. Prosser's improvements in supplying steam boilers with water, comprehend,

1. An improved compound feed and brine pump, the characteristic qualities of which (however it may be constructed) are that the piston is impelled in the act of discharging the waste water or supersaturated brine from the boiler by the hot brine itself, by which means no greater amount of power is required to work the compound pump than would be necessary for a small feed pump only—that the waste water is not impeded in its escape by the resistance of a loaded discharge valve as heretofore used in brine pumps—and that the valve of this pump is either a slide or other suitable valve, opened and shut by mechanical means so as to admit of the entrance of the brine into the pump, and its free and unimpeded discharge therefrom.

2. A method of extracting the air from feed water by the combined action of heat and a force pump, so as to prevent the corrosion of iron boilers, and of the iron tubes employed therein.

The improvements "in clearing out the tubes of steam boilers" consist in causing a jet or blast of steam to pass from end to end of the tubular flues, so as to remove the soot, ashes, and other deposits accumulated therein.

WILLIAM EDWARD NEWTON, of Chancery-lane, civil engineer. *For improvements in the construction of ships and vessels, and in steam boilers or generators.* (A communication.) Patent dated August 22, 1850.

The improvements under the first head of the title have special relation to those vessels which are intended to be furnished with stern propellers, and consist in making the line of keel inclined to the line of bilge (which is parallel to the water-line), and of gradually increasing the depth towards the stern, so as to admit of the employment of a propeller of greater diameter in proportion to the depth of midship section than

could be used in vessels of ordinary construction. The displacement of the vessel when thus built, is only increased in proportion to the additional depth of keel at the stern.

The improvements in steam boilers consist in arranging the direct flues in one cylindrical boiler, and the return flues in another cylindrical boiler placed above the first; the two being so connected together by stay bolts through the outer casing as to admit of a free water circulation.

Henry Holland, of Birmingham, umbrella furniture manufacturer. *For improvements in the manufacture of umbrellas and parasols.* Patent dated August 22, 1850.

These improvements, as claimed, have reference

1. To a method of constructing the ribs hollow, and of an elliptical shape, the joint of the tube being at the side.

2. To the construction of the stretchers. And

3. A method of securing the ornamental nibs at the ends of the ribs by inserting the nib into the tubular rib instead of attaching them in the ordinary manner.

Daniel Illingworth, of Bradford, worsted spinner. *For certain improvements in machinery for preparing all descriptions of wool and hair grown upon animals for the carding, combing, and other manufacturing processes.* Patent dated Ag ust 22, 1850.

Claims.—1. The application to machines employed for the preparation of wool, hair, and fur of animals of a revolving beater or fan, and also the general arrangement and combination of parts as shown.

2. The employment of an instrument, or series of instruments, rotated by a shaft or shafts for the purpose of acting on the material in its passage through the machine, and also making the beaters of animal membrane.

3. The employment in carding machines of an additional pair of rollers placed in front of the feed-rollers, and revolving at a slower rate of speed, for the purpose of straightening the material previous to its entering the machine.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman. *For improvements in cutting types and other irregular figures.* (A communication.) Patent dated August 29, 1850.

In this machine the cutting tool is mounted in a stationary bearing, which is capable of adjustment in vertical guides, so as to bring the tool to its proper position over the block of wood or other material to be operated on. The rotary motion of the cutting tool is thus rendered steadier and more accurate than in the ordinary carving machine, in which the cutter has an eccentric traverse. The block under operation is secured to a bed which has a compound traverse motion, for the purpose of bringing every part of the block under the action of the cutter. In addition to the horizontal traverse, the bed has also in some cases a vertical motion, especially when the machine is employed in producing bas reliefs, and raised or other figures of uneven and irregular surface; but this motion is unnecessary in cutting types and other simple figures. The requisite motion is imparted to the bed and block by a horizontal frame constructed on the principle of the pentagraph, and consisting of four or more bars jointed together, and connected at one corner to the bed, and carrying at the opposite end a tracer or point, which, when moved over a pattern, gives a corresponding motion to the bed and block under the cutting tool. Besides this horizontal pentagraph, there is also a second one, which, being placed vertically, and connected to the same centre and at the same point as the horizontal pentagraph, imparts to the bed and block a motion corresponding to that of the tracer at the opposite end of the frame.

This machine may be employed for cutting irregular figures of various kinds, and is especially applicable to cutting tracery, Gothic work, and curved or eccentric mouldings. It is also capable of producing forms or figures of different sizes from the same pattern; that is, not only of the same size as the original, but exact fac-similes of it on a reduced scale—thus obviating the necessity of having a large number of patterns of different sizes.

Claims.—1. The adaptation to the moveable bed which carries the block or blocks to be operated on under the cutting-tool or tools, of an arrangement of levers on the well-known principle of the pentagraph, whereby the bed and block at one end of the frame are caused to follow the motions of a tracer or point over a pattern at the opposite end of the frame.

2. The combination of a horizontal and vertical pentagraph with a bed mounted in vertical and horizontal guides, whereby not only a horizontal but a vertical motion may be communicated to the bed and blocks.

George Augustus Huddart, of Brynkir, Caernarvon, esquire. *For certain improvements in the manufacture of cigars, and certain improved apparatus for smoking cigars.* Patent dated August 29, 1850.

This invention, as claimed, consists :—

1. In closing and securing the external leaf or wrapper of a cigar with a cement or varnish impervious to moisture, and in applying to this purpose amber, gutta percha, India rubber, or other suitable waterproof cements or varnishes.

2. In dressing or coating the twisted or but-end of a cigar intended to be introduced between the lips of the consumer, with a thin skin or covering adhering firmly to the cigar, and unaffected by, and impervious to, moisture; and in the application to this purpose of amber, gutta percha, India rubber, or other suitable substance.

3. In permanently fixing or cementing to the twisted or but-end of a cigar, tubes, or mouth-pieces composed of amber, gutta percha, or India rubber.

SIR JOHN SCOTT LILLIE, Companion of the most Honourable Order of the Bath, of Paris. *For certain improvements in the application of motive power.* Patent dated September 5, 1850.

1. It is proposed to propel boats or vessels by means of rapid currents of air or other elastic fluid driven by a blower or other mechanical means through inverted troughs, and acting against the water in their passage from end to end. There may be one or two inverted troughs to each boat, and in the latter case they are to communicate with the vertical pipe in connection with the blower and to be also furnished with valves, so as to direct the current of air either way at pleasure.

2. Paddle-wheels may be suspended in such a position as to admit of the issuing currents of air striking their floats and imparting a rotary motion, by which the vessel will be propelled. The paddle-wheels are also proposed to be set in motion by currents of air directed against them through tubes or pipes.

3. Locomotives and carriages on common roads may be propelled by connecting their driving wheels with a paddle-wheel, caused to revolve by currents of air striking against the floats.

LIST OF SCOTCH PATENTS FROM 22ND OF JANUARY TO THE 22ND OF FEBRUARY, 1851.

James Slater, and John Nuttall Slater, of Dunscar, Bolton-le-Moors, Lancaster, bleachers, for certain improvements in machinery or apparatus for the stretching and opening textile or woven fabrics. January 23; four months.

James Hamilton, of London, engineer, for improvements in machinery for sawing, boring, and shaping wood. January 23; six months.

Julian Bernard, of Green-street, Grosvenor-square, Middlesex, gent., for improvements in the manufacture or production of boots and shoes, and other articles made of leather, dressed skins, or other materials, and in the materials and machinery or apparatus to be employed therein. (Being a communication.) January 24; six months.

Richard Archibald Brooman, of the firm of Messrs. J. C. Robertson and Co., of 166, Fleet-street, London, patent agents, for improvements in steam machinery, and apparatus connected therewith. (Being a communication.) January 24; six months.

Richard Archibald Brooman, of the firm of Messrs. J. C. Robertson & Co., of 166, Fleet-street, London, patent agents, for an improvement or improvements in abdominal supporters. (Being a communication.) January 24; six months.

Charles de Bergue, of Arthur-street, West, London, engineer, for improvements in the construction of the permanent ways of railways. January 27; six months.

Samuel Clift, of Bradford, near Manchester, manufacturing chemist, for improvements in the manufacture of muriatic acid, soda, potash, glass, and of chlorine. January 27; six months.

William Beckett Johnson, of Manchester, manager, for Messrs. Ormerod and Son, engineers, for certain improvements in steam engines, and in apparatus for generating steam, such improvements in engines being wholly or in part applicable, whether other vapours or gases are used as the motive power. January 29; six months.

Samuel Morand, of Manchester, for improvements in apparatus used when stretching and drying fabrics. January 29; six months.

Edward David Ashe, of Brompton, Middlesex, Lieutenant in Her Majesty's Royal Navy, for a new and improved nautical instrument or instruments, applicable, especially among other purposes, to those of great circle sailing. January 29; six months.

William M'Gavin, of Glasgow, miller, for certain improvements in steam boilers, and furnaces and fire-places, and in the prevention of smoke. January 29; six months.

Joshua Horton, of Ætna Works, Smethwick, Stafford, steam engine boiler and gasholder manufacturer, for improvements in the construction of gasholders. January 30; six months.

Peter Fairbairn, of Leeds, York, machinist, and John Hetherington, of Manchester, Lancaster, machinist, for certain improvements in mouldings for casting pipes, railings, gates, agricultural implements, and other metal articles, and also in preparing patterns or models for the same. January 31; six months.

John Stopporton, of the Isle of Man, engineer, for certain improvements in propelling vessels, parts of which improvement are applicable to steam engines and pumps. January 31; four months.

Frederick W tson, of Hulme, near Manchester, gent., for improvements in sails, rigging, and ships' fittings, and in machinery and apparatus employed therein. February 3; six months.

Nathaniel Jones Amies, of Manchester, manufacturer, for certain improvements in the manufacture of braid, and in the machinery or apparatus connected therewith. Feb. 3; six months.

Benjamin Rotch, of Lowlands, Middlesex, Esq., for a factitious saltpetre, and a mode by which factitious saltpetre may be obtained for commercial purposes. February 3; four months.

James Webster, of Leicester, engineer, for improvements in the construction and means of applying carriage and certain other springs. February 5; six months.

Henry Bessemer, of Baxter-house, Middlesex, civil engineer, for certain improvements in the sugar-cane press. February 6; six months.

Selim Richard St. Clair Massiah, of Alderman-walk, New Broad-street, London, for certain improvements in the manufacture of artificial marble and stone. February 7; six months.

Joseph Shaw, of Paddock, near Huddersfield,

York, cloth finisher, for certain improvements in constructing and working certain parts of railways. February 7; six months.

Francis Clark Monatis, of Earlston, Berwick. Scotland, builder, for an improved hydraulic syphon. February 7; six months.

Richard Stuart Norris, of Warrington, Lancaster, civil engineer, for certain improvements in the construction of the permanent way of railways, bridges, locks, and other erections, wholly or in part constructed of metal; also improvements in breaks for railway carriages. February 10: six months.

William Wield, of Manchester, engineer, for improvements in machinery for turning and burnishing. February 10; four months.

William Edward Newton, 66, Chancery-lane, Middlesex, civil engineer, for improvements in machinery or apparatus for producing ice, and for general refrigeratory purposes. (Being a communication.) February 11; six months.

Ewald Riepe, of Finsbury-square, London, merchant, for improvements in refining steel. (Being a communication.) February 12; six months.

Peter Claussen, of Cranbourne-street, Middlesex, gent., for certain improvements in bleaching, in the preparation of materials for spinning and felting, and in yarns and felts, and in the machinery employed therein, part of which improvements have been communicated to him by a Foreigner residing abroad. February 12; six months

Alfred Vincent Newton, 66, Chancery-lane, Middlesex, mechanical draughtsman, for improvements in manufacturing looped or other woven fabrics." (Being a communication.) Feb. 14; six months.

Charles Gotthalf Kind of Paris, engineer, and Charles Alexis de Wendel, ironmaster, also of Paris, for improvements in the process, and instruments to be used for boring the earth, and sinking shafts of any given diameter, for mining and other purposes, and in the means of lining such shafts. February 14; six months,

James Thomson Wilson, of Stratford-le-Bow, Middlesex, chemist, for improvements in the manufacture of alum, and in obtaining ammonia. February 14; six months.

David Ferdinand Masirata, of Golden-square, Regent's-park, Middlesex, gent., for improvements in obtaining motive power when compressed air is used. February 17; six months.

William Burgess, of Newgate-street, London, gutta percha dealer, for improvements in machines for cutting turnips, and other substances. February 17; six months.

Thomas Wickstead, of Oldford, Middlesex, civil engineer, for improvements in the manufacture of manure. February 19; six months.

Bennet Woodcroft, Furnival's-inn, London, for improvements in machinery for propelling vessels. February 21; six months.

LIST OF IRISH PATENTS FROM 21ST OF JANUARY TO THE 19TH FEBRUARY, 1851.

William Edward Newton, 66, Chancery-lane, Middlesex, civil engineer, for improvements in obtaining, preparing, and applying zinc and other volatile metals, and the oxides thereof, and in the application of zinc, or ores containing the same, to the preparation or manufacture of certain metals or alloys of metals. January 22.

John Ransom St. John, New York, America, engineer, for improvements in the process of, and apparatus for, manufacturing soap. (Being a communication.) January 24.

James Young, of Manchester, Lancaster, chemist, for improvements in the treatment of certain bituminous mineral substances, and in obtaining products therefrom. February 1.

Peter Claussen, of Cranbourne-street, Middlesex, gentleman, for improvements in bleaching, in the preparation of materials for spinning and felting, in yarns and felts, and in the machinery employed therein. (Partly communicated.) February 1.

John Clare, of Exchange-buildings, Liverpool, for improvements in the manufacture of casks. February 3.

Benjamin Rotch, of Lowlands, Middlesex, esquire, for a factitious saltpetre, and a mode by which factitious saltpetre may be obtained for commercial purposes. Feb. 4.

James Corry, of Belfast, Ireland, damask manufacturer, for improvements in machinery or apparatus for weaving figured fabrics, which machinery or apparatus is also applicable to other purposes for which Jacquard apparatus is or may be employed. Feb. 5.

Edward Clarence Shepard, of Parliament-street for improvements in electro-magnetic apparatus, suitable for the production of motive power, of heat, and of light. Feb. 7.

Zachariah Morley, of Regent's-park, Middlesex, Esq., for certain improvements in the means or methods of, or apparatus or machinery for, decomposing water, and applying the products to useful purposes. (Communication.) Feb 7.

Jasper Wheeler Rogers, of Dublin, civil engineer, for certain improvements in the preparation of peat, and in the manufacture of the same into fuel and charcoal. Feb. 7.

John Matthews, of Kidderminster, foreman, for improvements in sizing paper. Feb. 8.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Millward, of Birmingham, plater, for certain improvements in electro-magnetic and magneto-electric apparatus. February 28; six months.

Charles Felton Kirkman, of Argyle-street, gentleman, for certain improvements in machinery for spinning and twisting cotton, wool, or other fibrous substances. February 28; six months.

Henry Willis, of Manchester-street, Middlesex, organ-builder, for improvements in the construction of organs. February 28; six months.

James Leach, of Littleborough, Lancaster, cotton spinner, for certain improvements in machinery or apparatus for carding, spinning, doubling, and twisting cotto and other fibrous substances. February 28; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in portable bedsteads, and in sacking bottoms. (Being a communication.) February 28; six months.

William Milner, of Liverpool, Lancaster, safety-box manufacturer, for certain improvements in boxes, safes, or other depositories for the protection of papers or other materials from fire. March 3; six months.

Alfred Vincent Newton, of Chancery lane, Middlesex, mechanical draughtsman, for improvements in the preparation of materials for the production of a composition or compositions applicable to the manufacture of buttons, knife and razor handles, in inkstands, door-knobs, and other articles where hardness, strength, and durability are required (Being a communication.) March 4 six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Feb. 28	2715	Charles J. Thrupp and Co.	Oxford-street	Stanhope landaulet.
March 1	2716	J. B. Davis	Roupel-street, Lambeth	Clear-way valve.
"	2717	Samuel Brown	Sheffield	Tubular lightning-conducter.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Feb. 20	62	Henry Inskip	Hertford	The United Service flask.
"	63	T. F. Gates and E. C. Gates	Pimlico	Robe pour Dames Mariées.
21	64	T. R. Brunell	13, Newman-street, London	Tap.
"	65	W. Wharton	Euston-square	Noiseless wheel.
"	66	J. H. Noone & W. Exall	Queen's-crescent, Camden-town	Spring-carriage head.
"	67	D. S. Brown	Old Kent-road	Blower.
22	68	W. Muir and H. Goss	Salford, Lancaster	Theodolite.
"	69	J. Mash	Kentish-town	Reflecting stove-grate.
24	70	R. Kittan, jun.	Rudham, Norfolk	Ventilating funnel for liquids.
"	71	D. S. Brown	Old Kent-road	Weighing machine.
25	72	W. E. Currett	Leeds	Portable high-pressure boiler.
26	73	W. Higginbottom	Manchester	Joint for water-pipes, &c.
27	74	F. G. Yeates	Winckworth's-buildings, City-road	Box for string, &c.
"	75	F. G. Yeates	Winckworth's-buildings, City-road	Lever-knife.
"	76	J. Gedge	Wellington-street, Strand	The bellows stove.
28	77	Charles Bolton	Dorset-street, Portman-square	Stitching machine.
"	78	Thomas Geake	Sherborne	Expanding dining-table.
March 1	79	Leonard Hicks	Leeds	Hat.
"	80	William Stahl John Burt	Great Pulteney-street Church-street, Chelsea	Self-acting card case.
3	81	R. G. Diamond	Silver-street	The "Koh-i-noor," or improved omnibus.
"	82	Duffield Offord	Great Yarmouth	Masticating knife and fork.
"	83	J. C. Jones & Co.	Soho-square	Twin piano-forte.
"	84	F. Haysome	Belgrave-terrace	Life-boat.
5	85	L. Foncart, M.D.	Glasgow and London	Chest-expander, or spinal rectifier.
"	86	W. L. Turner	Cambridge-street, Hyde Park-square	Envelope letter.

Errata on Mr. Bills's Paper.

Page	column	line	from	for	read
162,	1st,	10	bottom,	"my,"	"any."
"	2nd	4	top	"when,"	"where."
"	"	6	"	"when,"	"where."
163	1st	27	"	"posing,"	"poring."
"	2nd	21	bottom	"exists,"	"rests."
"	"	17	"	"when,"	"where."
"	"	16	"	"$\pm p\sqrt{-1}$,"	"$p \pm q\sqrt{-1}$."

In the equation at bottom of page 163, the second term should be $-2x^2$, instead of $-2x$; also, in the equation about the middle of the second column of that page, it was an inadvertence in using the same letter, n, in two different situations: it will occasion no confusion if the reader will please to bear in mind that the n in the absolute term is to be considered as having no connection with the index n.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Paine's Magneto-Electric Machine and Light.—The Specification—(*with engravings*) 181
On Impossible Equations. By Robert Harley, Esq.—(*continued*) 185
American Transatlantic Steamers 187
Wind Screw for River Propulsion—(*with engravings*) 190
The late Fires, and Fireproof Partitions 191
Chevalier Claussen's Flax Process 192
Brick-making at Roorkee by Ransome's Patent Machinery 193
On River Water. By Professor Murray 194
Concrete Cocoa-nut Oil—Enquiry 195
What is yet to be done by the Arts. By Commissioner Ewbank 195

Specifications of English Patents Enrolled during the Week:—
- Prosser ......Steam Boilers 196
- Newton ......Steam Boilers 196
- Holland ......Umbrellas, &c. 197
- Illingworth ...Preparing Fibrous Materials 197
- Newton ......Types 197
- Huddard ......Cigars 197
- Lillie ......Propelling 198

Monthly List of Scotch Patents 198
Monthly List of Irish Patents 199
Weekly List of New English Patents 199
Weekly List of Designs for Articles of Utility Registered 200
Weekly List of Provisional Registrations 200

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1440.] SATURDAY, MARCH 15, 1851. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

FULLER'S REGISTERED LANDAU.

Fig. 1.

Fig. 2.

FULLER'S REGISTERED LANDAU.

[Registered under the Act for the Protection of Articles of Utility. Thomas Fuller, of Kingsmead-street, Bath, Carriage-builder, Designer.]

Mr. Fuller is the author of the well-known and excellent practical treatise on wheel-carriages. The form of landau which he has now introduced, differs from others in two important particulars; first in the application of the side glasses; and, second, in the roof being moveable either backwards or forwards, entirely clear of the heads of the persons inside. Fig. 1 is a side-elevation of the body of this landau when closed; and fig. 2 a view of it as it appears when opened up. AA are the hinges upon which the front and back portions of the head are folded; these are placed considerably further towards the back and front than hitherto, and with this view supplementary rails, BB, are employed in the formation of the body which admits of the introduction of the additional side-glasses CC.

THE EDUCATION AND FOOD QUESTIONS—CONSIDERED IN THEIR EFFECTS ON SKILLED INDUSTRY.

In Number 1435 of the *Mechanics' Magazine* it was said, as is very generally admitted, "that some fund must be provided for the education of the very poor." In what that education should consist, so as to enable the poor child to earn its future livelihood does not seem to have been investigated; yet, next to the laying in by some means a foundation of religion and morality, a training in honest industry cannot but be regarded as of first-rate importance. To the very poor, as to the rich, reading and writing are certainly important means of acquiring information, and are often useful as affording occupation for an idle hour; but as we have already more clerks than there is employment for, it is not by writing that bread could be earned. The question then is, what should the poor be taught to enable them to earn a subsistence? The ready reply at first sight would be "Give them industrial training." This would be unanswerable were we not already overstocked with workers in every branch, and it may be said, of common as of skilled labour; so that the bringing thousands, nay, millions of new competitors into the labour-market would, without affording them a sufficiency of pay for bare existence, reduce the present thrifty self-supporting mechanic to a state bordering on poverty. Education has then to be considered, not only as regards the early years of a poor child, but as affecting his future prospects in this life, and also its bearing on those of a superior grade who now by skilled industry earn a competency.

Of late years the superior education and turn of mind of mechanics, render questions of political economy familiar to them, so that means of remedying the over population of the country comes within the sphere of their acquirements.

Persons who have been included in the general term of the labouring classes, consist in fact of two very different grades, the skilled, and the unskilled labourers. The skilled, generally speaking, have obtained their knowledge and superiority from the care bestowed on their education by thrifty industrious parents. Nor is it either reasonable, or moral, or conducive to the general welfare of the community, that such laudable foresight of parents should be discouraged by affording—as seems to be proposed by one scheme now in agitation—*gratuitous* education of a superior kind to both of these grades alike. Nay, worse, that in the same school, not only should the pauper child receive the same instruction, but also that there should be forced into it the offspring of the beggar, the thief, the idle, vicious and depraved of every denomination. No doubt can be entertained but that it is as much to the general interest of society, as it is congenial to benevolence, that all such young outcasts should be snatched from perdition, and reared in habits of honest industry; how then can this be effected without injury to the rising generation of children of the virtuous?

Confine pauper children and those of the depraved to unskilled labour it may be said. Here again over population presents an insuperable bar to any certainty

of employment for them. The market for agricultural labour is already grievously overstocked; so is that for common labour of all descriptions. Even in cotton mills and such like manufactories the candidates for employment greatly exceed the number of hands required. Malthus has exhibited that excess of population always leads to a natural cure, plague, pestilence, famine. We have had a taste of the first remedy during the visitation of cholera—Ireland of that of famine; but we have now, happily, within an easy grasp, an artificial cure, namely, the means of educating and providing for our superfluous population by colonising with it the distant possessions of the crown. The *Athenæum* lately pointed out this artificial remedy. This publication has brought to notice that we have millions of broad acres in many parts of the globe waiting only the hand of man to convert them into lands of plenty; that we have hundreds of thousands of poor, willing and able to work, yet finding no employment; and that we have ships rotting in our harbours, more than ample for the conveyance of these people to our foreign possessions; but it adds, that we have not amongst us sufficient harmony of purpose to combine these several advantages for the production of an useful end.

It is true that a great tendency to emigration has of late sprung up; but in effect it little contributes to the diminution of the superfluity of labouring hands, since those who emigrate are most of them possessed of capital, though often but a small one; withdrawing it from home diminishes to its amount the source of payment for labour; so do our heavy poor-rates, and so would a rate imposed for general education. Be the contributor affluent, be he ready, what these rates absorb is so much withdrawn from the power of purchasing the products of labour, whether mere luxuries or the common comforts of humble life.

The mechanics of the country are powerful; is it possible to rouse them to the formation of some plan for the education of the lower grades of the people in our colonies instead of at home? It were desirable for the welfare of the community at large, to the interest of the labouring classes in particular, and infinitely more so to that of the proposed colonists.

In the small volume "The Charities of London," page 156, it is shown that a million of paupers are maintained in England and Wales at an average expense of 5*l.* 16s. a year each; that a single year's maintenance would "convey a pauper with a guinea in his pocket to Upper Canada; two years maintenance would convey him to Cape Town or Port Natal. Three years maintenance would distribute paupers over Australia, Van Dieman's Land, or New Holland." Great would be the benefit by the emigration of able-bodied paupers, but still much more would the country be relieved by the maintenance and education of pauper children in our colonies. Children may be supposed on an average to remain chargeable half a dozen years in a parish workhouse,—setting the savings, by less quantity of food and clothing for them than for adults, against the cost of tuition,—a parish sending its children even so far as to Australia would save no less a sum than 17*l.* 8s. for each child; 1,740*l.* upon every hundred children.

Many are the means by which children of the lower classes might be well educated in our colonies on a self-supporting principle; amongst others, by employing part of their time in the cultivation of new land, their labour would more than pay their maintenance. "Children are wealth," say all reports of emigrants to under-peopled settlements.

It might be urged, that in a distant colony children would be over-worked, that their religious and moral training would be neglected, and ordinary schooling in reading, writing, and so forth, altogether abandoned. A mistaken notion, provided that competent schoolmasters and mistresses were engaged, that a certain portion of each child's time were allotted to school business, and that some agent of Government at each establishment were required to visit it at *uncertain* times, and to report particulars by filling up printed forms periodically sent home; besides that, power might be given to the local government to check on its own responsibility any abuse that might arise.

In the praiseworthy attempts that have lately been made to prepare destitute children for colonisation, it has been lost sight of, that every expense attendant on the experiment is more costly at home than it

would be in our colonies; food is much higher priced, sufficient clothing dearer, because a greater quantity is essential in this climate than is required in a warm healthy one; even masters, and other attendant persons must be paid in hard cash at home, but would be amply remunerated abroad by a moderate grant of land. Twenty acres at Port Natal are worth to Government but 10*l.* Schoolmasters having numerous families would find themselves in a superior situation with little addition to such a grant than they usually are at home, since the average pay of village schoolmasters is but 9s. 7d. a week.*

Should the sufficiency be doubted of such supervision as is above indicated, the aid of philanthropists might be called in. We have had our Howards, Frys, and Allens, who spared not exertions in foreign lands to better the condition of the poor; we have now in Mrs. Chisholm a female in independent circumstances braving perils by land and by water in the cause of emigrants; nor can it be doubted but that many an individual would spring up, if need were, to see that justice were done to poor children educated in a foreign land.

The saving to the country of 1,740*l.* a year for every hundred children sent for education to our colonies, might be much increased were Government to lend their ships as transports; for it was stated early in last year to the Society for Promoting the Emigration of Poor Needlewomen, that thereby a third of the ordinary passage-money might be saved. The paper was accompanied by the calculation proving this; although the ship's crew were paid and victualled as in the Navy, and a reasonable sum allowed for wear and tear of the vessel whilst so employed. Adding this saving of a third to the still more considerable one, in consequence of the passage-money of a child being but half of that of an adult, the country would be benefited by such colonization to a much more considerable amount than that above stated, of 1,740*l.* for every hundred poor children.

It may be objected to the employment of Government vessels for any kind of transport service, that their wear and tear at sea is greater than when they are laid up in ordinary in our harbours. This—so far as printed documents attest—is not the fact. For example, in the blue-book containing the Report, &c., of the Select Committee of the House of Commons on the Navy, 1848, it appears that a vessel, the *Wellington*, which had been as little in service as any one, having never been in commission and service more than *one month and three days*, stood in need of repairs estimated at no less than "19,766*l.*," yet that were that sum to be expended upon her, still she could be expected "to last but six years." The sums that had already been spent upon her whilst lying in harbour unemployed are not specified in the blue-book, though they must have been considerable; for it is stated that she had been "partially roofed in," and lately "new coppered;" of course she had received, too, the usual periodical paintings and petty repairs, if not others of more considerable amount. For an example, *per contra*, of the wear and tear of a ship in actual service, times long gone by must be had recourse to—times of the last wars. It is recorded in a letter to Earl Spencer, February, 1799,* that the *Bellerophon* was at that moment still in commission, after having been *thirteen years* in service without having had *anything done to her but common fittings.* The same ship continued in service for the next following sixteen years; still, as far as has appeared, without great repairs, when, being on service on the coast of France, Buonaparte took refuge in her. She conveyed him thence to this country, and from England to St. Helena, making altogether a service of thirty years. Some time after the *Bellerophon's* return home, her name was bestowed on a new vessel, she herself being still employed, under another appellation, in some harbour service. These examples afford proof of the superior durability of ships in active service over others lying idle in ordinary. Could our ships of war be better employed than in the peaceful occupation of conveying our poor to distant lands of plenty?

Supposing it were deemed objectionable to incur the expenses of emigration

* See "Monthly Paper" for March, 1851, p. 81. This includes villages of 1,200 inhabitants. The master has frequently out of that scanty pay to provide a house for himself.

* Naval Papers, No. II., page 37.

on parish account, much as it would relieve the present burthen on our poor-rates, another mode may be indicated, by which colonization by paupers and other poor might be effected. There seems good reason to conclude that Government would eventually gain by granting lands, rent free, for a certain period, to trustworthy individuals, making it a condition that they should engage to convey a given number of paupers, half of them children, to the assignment, supporting and employing them there for a limited term. The Canterbury settlement affords convincing proof that persons of a superior class are emigrating, though having to purchase land, and to pay half the passage-money of their intended labourers. It is not, however, many persons of capital who can be expected to leave their native country thus, but numbers would present themselves as candidates for colonization could they be spared a present outlay for the purchase of land, though after being brought into cultivation they could well afford either to pay a reasonable rent for it, or its value once for all. A well-organized plan for such a new establishment might be easily devised, but this Magazine is not the place to enter into the requisite details.

It will have been perceived that the object of these lines is that of providing for the future subsistence of the children of the poor, as well as for their present education, without increasing the distress which want of employment often occasions the self-supporting artizan to suffer. There can be no resulting benefit to the community by teaching children to read and write, if when they come to years of maturity there be no employment for them. However good a scholar a boy may be, however moral may be the sentiments imbibed in school, still eat he must; the cravings of unsatisfied hunger may by good feelings be withstood for a while, but ultimately must lead to unhallowed means of obtaining bread. If this be true, we should look more to what a child's means of earning it will be after he is twelve years old, than to the literary training he may receive before that age. We have above a million of paupers in England and Wales alone—of what avail to them can schooling be, since it affords not the bare necessaries of life? It is not want of education, but want of food that throws the greater part of juvenile delinquents into our courts of justice. Let education, then, be coupled with some scheme for affording employment for youth and man. If a better one than colonization presents itself, it would be that superior plan that should be adopted —if no more practicable one be devised; in this case it were well worthy the endeavours of the benevolent, as of the interested, to perfect and amend a scheme of which the bare outline has been traced above, and thus promote the education for useful purposes, of the rising generation of poor, and provide for their future well-being; whilst at the same time a continuance of that of the self-supporting industrious classes should no longer be endangered by excessive competition.

M. S. B.

ON MR. FROST'S SUPPOSED DISCOVERY IN STEAM.

Sir,—The extraordinary augmentation in the tension of really *dry* steam, heated out of contact with water, alleged by Mr. Frost to be produced by slight increments of temperature, would in truth amount to the discovery of a new power in steam, and be of the utmost importance, however worthless the theory by which it is his pleasure to explain it. Having, therefore, in my former communication (*ante*, p. 172) disposed of the phantasy of a new substance to be called "stame," let us now examine the facts upon which he rests his supposed discovery. I do not refer to his experiments with steam in glass tubes, for so carelessly were they conducted, and their results are so opposed to analogy and all former experiments, that they do not deserve a moment's attention; but in regard to the facts elicited in the actual working of a steam-engine, authenticated as they are by respectable and intelligent persons, it is perhaps worth while to notice them.

It will be proper to give the statement of these experiments in Mr. Frost's own words:—

Further Experiments.

This is to certify that we, the undersigned, met together, and witnessed the following experiments:—

First, an engine working under ordinary circumstances, with a pressure of 21 lbs. on boiler, engine made 2000 revolutions; the steam passing through a surface condenser

in a cistern, heated the water therein from 48° to 62°, and engine exhausted the steam on boiler.

Under the second experiment, by heating the steam apart from water, the engine ran 2000 revolutions, and the steam condensing in the surface condenser heated the water in cistern from 61° to 70°, and the pressure of steam on boiler increased from 21 lbs. to 37 lbs.

T. H. SECOR, Secor Iron Works, New York.

ALEX. H. STEVENS, Principal, New York University.

W. CALDWELL, Engineer, Steamers *America* and *Asia*.

EDMUND TUTHIL, Engineer, Secor Iron Works.

JOHN LEITCH, Captain, Steamer *America*.

JAMES HOW, Union White Lead Works, Brooklyn.

WM. ARTHUR, Vulcan Steam Works, Brooklyn.

The condenser fitted with mercurial gauge showed a steady vacuum of 12 lbs., therefore the effective steam power being 12 lbs. in first experiment, and $12+37=49$ lbs. in second experiment, while 14° of heat was expended in the first, and only 9° of heat in second.

Then, as

$$12 : 49 :: 1 : 4{\cdot}1 \times \frac{14}{9} = \frac{57{\cdot}4}{9} = 6{\cdot}36$$

times the effective force derived from an equivalent of caloric from heated steam (or stame) than was derived threfrom when applied to steam.

In this calculation it is to be observed, Mr. Frost employs the two ratios of 12 to 49, and of 9 to 14, or the single ratios of 1 to 6·36, to represent the greater amount of work done with a given quantity of caloric by his method of using it, the separate ratios having reference to the comparative states of the boiler and the condenser. Now let it pass, although it is an egregious error, that the first ratio in terms of the pressure of the steam in the boiler, correctly expresses the expenditure of heat in the respective experiments; for it cannot be denied, that if the fire be equally maintained, and heat saved, it must accumulate in the boiler. Let it be admitted also, that the different degrees of temperature communicated to the water in the condenser as indicated by the second ratio is another criterion of the saving of heat. To ascertain this point, it is obvious that we may institute inquiries, either as to the respective quantities of caloric abstracted from the boiler, or as to those that are discharged into the condenser. Sensible men will not attempt the first, but if the two methods could be conducted with equal accuracy, they would, apart from the waste of heat attendant on transmission through the cylinder, necessarily give the same result. The saving of heat that is proved by its absence from the condenser, is exhibited in the boiler by its retention.

Now, Mr. Frost is not content with choosing between these two methods, but insists on saving his heat twice; once in the boiler, in the ratio of 49 to 12, and again in the condenser in the far-different ratio of 14 to 9. This will never do. His conduct is like that of a man, who having been engaged for some time, and much to his satisfaction, in a qualitative and quantitative analysis of a bottle of pleasant liquor, appeals to the fair companion of his life as to the number of glasses on which he has experimented. He is told that the half empty state of the bottle indicates he must have taken six; but being either under the influence of the said pleasant liquor, or else being possessed of a true Hibernian exuberance of ideas, he arrives himself at the sage conclusion that the number must be twelve, for have not six vanished from the bottle? and have not six vanished he knows where?—and that's a dozen any how. Mr. Frost's mind is in the same state of confusion, although with the advantage on his side of having had the tee-total element for the subject-matter of his cogitations. He looks at the boiler, and sees that a quantity of caloric has been abstracted—he looks at the condenser and sees that the temperature of its water has increased, and although this is a necessary consequence of the transference of steam, and therefore of heat from one to the other, he insists on measuring it, both before and after, it has passed through the cylinder.

It is obvious that the state of the condenser affords the only satisfactory evidence in these comparative experiments. By this test the expenditure of heat is in the ratio of 14 to 9, or the saving is 35 per cent. By the boiler test, the ratio is as 49 to 12, or the saving is 75 per cent. Now the great difference in these results, when there ought not to be any,

arises, not only from the difficulty—I may say impossibility—of getting any accurate indications from the boiler, but from the absurd manner in which Mr. Frost has attempted it. He takes the differences of temperature in the condenser very properly for the terms of the ratio in that case; but in respect to the boiler, he takes the two extremes of the pressure of the steam! Even allowing him to substitute pressure for temperature, as a sufficient indication of it, and supposing that he had taken the differences instead of the extremes, he would still have been altogether wrong whilst neglecting to take into account the continual influx of heat from the furnace. In the second experiment, the difference is positive, instead of being, as in the other case, negative; and thus the transmission of heat being ignored, Mr. Frost would have arrived at an inconveniently triumphant result — namely, that the heating the steam more than supplied all the power required by the engine.

The condenser, we have seen, indicated a saving of heat to the amount of 35 per cent.; and I know no reason why we may not place dependence on this result: still it will be necessary to make some qualifying remarks. No information is afforded as to the construction of the boiler, nor of its evaporating power in relation to the demand for steam. It may have been that it was overtasked in this respect, as boilers too generally are; either from this cause, or from insufficient steam space, or from cramped and narrow steam ways, the steam may have been rendered in more than a usual degree watery, and as heat in this way passes into the condenser in an inefficient form, it would be wasted to a more than ordinary extent. The economizing of heat under such circumstances, if they really occurred, would be no fair criterion of what would take place under better yet common arrangements.

There is another qualifying observation to make. A saving of fuel is not a necessary result of a saving of heat. Caloric is wasted as well as used, and, whilst economizing in one direction, we may be losing in another. The condenser may give evidence of a less consumption of heat, and yet there may be a greater consumption of fuel; for as caloric is always more largely evolved than taken up by the steam, this wasteful surplus may be augmented by the very means employed to convert into work a greater proportion of the quantity absorbed. Whether the separate heating of the steam is, or is not, accompanied with this result, no attempt to ascertain it appears to have been made.

What are we to think of the attestations to these inconclusive experiments? —Do they refer also to the absurd calculation of the value of Mr. Frost's improvement? Surely these gentlemen—among whom is to be seen the Principal of New York University—did not mean to certify more than the fact of their having been witnesses of the experiments; and yet it does not appear that they have protested against the use of their names in a way that would lead to the impression that they guaranteed also the accuracy of the calculated results.

There is no doubt that, with our present arrangements, heat is very much wasted by the watery condition of the steam. The great fault is the small size of the boilers. Some years since I recommended a friend to have a boiler 16 feet long and 3 feet in diameter, for a 5-horse high-pressure engine. Subsequently, in contemplation of a larger engine, a 24-feet boiler, of 3 feet diameter, was also laid down. It was soon perceived that even this larger boiler was not too great for the same engine. When used alternately with the other, it was soon manifest that it was more economical; and its convenience in regard to the varying demand for steam, occasioned by the exceedingly irregular work of the engine, was very great. The important advantage of producing little smoke belongs also to large boilers; with proportionate furnaces and judicious stoking, there needs no especial apparatus for effecting this object. It may surprise many to be told, but it is a fact, that no ordinary kitchen fire produces, not merely relatively to the amount of coal consumed, but absolutely, so little smoke as a well-ordered and well-managed steam-engine furnace, and that without any smoke-consuming contrivances whatever. But, returning to the subject of dry steam, the French engineers say, that the carrying the flue in its second course round the boiler, somewhat above the water-line, is attended with considerable advantage; but I should fear that it is not quite a safe expedient.

I am, Sir, yours, &c.,

BENJAMIN CHEVERTON.

All heat, whether named SOLAR—that is, heat from the direct rays of the sun; or when the rays are expanded, as electric, galvanic, magnetic, or mesmeric,—heat from the spark, whether magnetic or electric,—heat from condensed air, or from flame,—heat evolved by chemical combination or disintegration,—heat produced by friction or percussion,—also heat in the animal and vegetable kingdoms,—is one and the same, but in modified intensities, and is considerably excited by causes, but springs all from one source, and that source is the SUN! The vivifying and exhilarating influence of the rays of that luminary pervade all nature, both organic and inorganic; and when light is chemically acted on, by coming within a certain distance of substances on the earth, then the sun's rays are expanded, and electricity pervades all space, producing the life-creating phenomenon in addition.

Light at a high altitude, the electric or magnetic spark, and highly and suddenly condensed air—like high-pressure steam when the hand is held near the orifice from which it issues—has no sensible heat to the animal feelings; but reduce the intensity of the light, the air, or the spark, by expansion, thus in the latter igniting any substance,—or, as in steam, by expanding in the atmosphere, the hand will then be injured if held in the flame or the steam; and, in the former case, the heat also becomes perceptible, beyond the direct rays of the sun.

Light and heat are so intimately connected, that a distinction cannot philosophically be drawn between them, but may for convenience be allowed.

Light is generated in the sun, and, expanding and pervading all space, is chemically attracted by everything gaseous—animal, vegetable, and mineral—on the earth, and thus, by chemical combination, becomes heat. Being imponderable, it can neither have substance or form. Heat is evolved in a greater degree by the action given to the molecules of any substance, by increased chemical attraction, or by a force crushing them together, *i.e.*, percussion.

Fire expands a substance placed in it, and the greater the intensity of the heat, and the longer the substance is kept in contact with it, the greater is the increase of the outward attraction, until such substance falls into a fluid state, or disappears in gaseous product, the minute molecules forming the substance being torn asunder by all the surrounding visible and invisible attracting agencies.

Lightning (electricity), which is concentrated light in its descent from the sun (the generator), is collected by certain clouds (acting as a battery), and when such charged clouds come within attracting distance of each other, if overcharged, an explosion ensues; the lightning invariably taking the form of fork; and being nearer our globe than any other object, is naturally attracted there, the light is then diffused by all chemical agencies. Sheet lightning, as seen to the observer, is merely the reflection of the fork on intervening clouds, which it lights up, like an artificial light behind a transparent screen.

There is one *invariable* natural law, in the conduction of heat, which has continued, and will continue through all eternity; that is, a difference in the attracting or conducting power of the attracting substances, from that of the substances attracted—causing, by a difference in the temperature, arising from a difference in the power of absorbing heat, expansion and attraction; and thus constant action or vibration; this difference in the two substances arises from a variety of different phenomena (perhaps the principal one is density), which makes a good or bad conductor or attractor.

My proposition that light and heat are one, is supported by passages which occur in Rumford's Essays on Heat, in Leslie on Heat, and in Hunt's Researches on Light; and the following remarks by those philosophers, and by Delaroche, Becquerel, Fresnel, and Melloni, are some which support that theory:

"If liquids are non-conductors of heat, they ought certainly, *on that account*, to be peculiarly well calculated for confining, and consequently furthering the operations of that heat which is *generated by light*, or by any other means, in their integrant particles, or in infinitely small insulated particles of other bodies that are dispersed about, or held in solution in them; as I have already more than once had occasion to observe."—*Rumford's Essays*, vol. ii., p. 353.

Many liquids are conductors; mercury and all the metals when fused.

"Rumford found that when pieces of ribbon were coated with a solution of gold,

those which were exposed to the strong light of the sun gradually changed colour, and in a few hours acquired a fine purple hue, whilst those preserved in darkness remained unchanged. He also found that by putting small pieces of charcoal into a glass tube filled with solution of gold or of silver, and exposing it to a temperature of C 99° (F 210°) for two hours in the dark, that veined gold or silver adhered to the surface of the charcoal. Similar tubes, filled as before, were exposed to the direct rays of a very bright sun; in less than half an hour veined specks of veined gold, or silver, in all its metallic splendour, appeared on the surface of the charcoal."—*Hunt on Light.*—(1844.) Sec. 16 and 17, p. 13.

"A remarkable analogy between the effects of heat and light deserves notice; and it is also of some practical importance in the preparation of the papers." (Photographic.) "If a piece of nitrated paper is placed on hot iron, or held near a good fire, it will be found that at a heat just below that at which paper chars, the salt is decomposed. Where the heat is greatest, the silver is veined, and immediately around it the paper becomes a deep blue; beyond this a pretty decided green colour results; and beyond the green, a yellow or a yellow-brown stain is made." ("We have already seen that Count Rumford found the nitrate of silver in contact with charcoal, or an earthy carbonate was soon reduced to the metallic state under the action of strong sunshine.")—*Ibid.*, sec. 51 and 52, p. 44.

"It appears to me that a broad distinction is established between the solar influence, light, and the solar influence, heat. That in many phenomena their operations so run together, that it is impossible to separate the one from the other, I am ready to admit; and also that it would appear from the experiments of Delaroche that light and heat are convertible into one another. The curious fact, discovered by this philosopher, that radiating heat becomes more and more capable of penetrating glass as the temperature increases, till at a certain temperature the rays become luminous,—almost seems to confirm this, did they stand alone. The results obtained by Melloni with the solar rays, do, as it appears to me, compel us to consider light and heat as two distinct powers *intimately* connected with each other in their operations."—*Ibid.*, sec. 415, p. 250.

"It has generally been admitted that these radiations which accompany light are different from each other, and that according to such and such a sensible substance, the active rays were also different; but I do not suppose that the question is so complex. In fact, the luminous phenomena, according to the theory of undulations, depend on the vibrations of the molecules of the illuminating body, which are transmitted to the retina by the intermediation of the ether, the molecules of which are themselves in *vibration.*" —(E. Becquerel.) "Fresnel, whose beautiful investigations have contributed to the triumph of this theory, has stated that the chemical effects produced by the influence of light, are owing to a mechanical action exerted by the molecules of ether on the atoms of bodies, so as to cause them to assume new states of equilibrium, dependent on the nature and the velocity of the vibrations to which they are subjected. This idea had been suggested to him by a remarkable experiment by M. Arago, the result of which was to show, that the chemical rays which influence the chloride of silver, interfere in the same manner as the luminous rays."—*Ibid.*, sec. 420, p. 254—5.

M. Arago remarks,—"The velocity with which a luminous ray *passes through* a given body, depends exclusively on the refringency of this body, and on *the velocity of the emission of the ray*, on the velocity it had *in vacuo.*"—*Ibid.*, sec. 422, p. 257.

"I have now given the hypotheses of M. E. Becquerel and M. Arago, which both lead to the conclusion, that the chemical influences of the solar rays are one of the phenomena of light."—*Ibid.*, sec. 423, p. 258.

"Melloni and M. E. Becquerel have both suggested the probability that the solar rays are but one principle—light; and that, as they are received upon bodies differently constituted, they produce the phenomena of colour and vision, of heat, or chemical action. We already know that the physical properties of heat and light are similar, that they can be similarly reflected, refracted, and polarized; and the same applies to the chemical principle."—*Ibid.*, sec. 441, p. 270.

"We have now seen that LIGHT, *heat*, *machine electricity*, and a *voltaic current*, all produce that disturbance on the surfaces, at least of solid bodies, which disposes them to receive vapours upon definite spaces. It will also be found, that any mechanical disturbance to which the plates may be subjected, will act in precisely the same manner as the above elements."—*Ibid.*, sec. 404, p. 239.

It appears to me to be probable, that one of the above elements exists along with the mechanical disturbance.

"If a body be exposed to the sun's rays, it will in every possible case be found to indicate a measure of heat exactly proportioned to the quantity of light it has ab-

sorbed."—"Enough has, I presume, been stated to establish the conclusion, that heat is only light in a state of combination."—*Leslie on Heat*, p. 160-2. 1804.

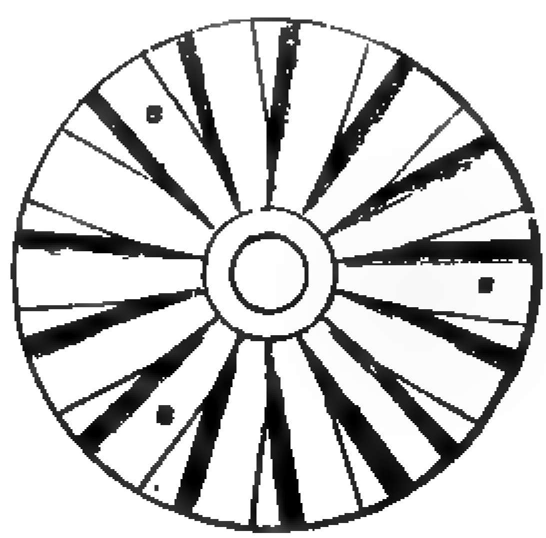
Having attended the excellent lectures on light and heat delivered by Professor Forbes, in Edinburgh University, during the session 1849-50; his observations and experiments illustrating the laws of heat and light have induced me to add the following eight conclusions to the essay in support of my theory:—

1. The transmission of heat and light are analogous.
2. Rays of heat, like rays of light, are both refracted and reflected.
3. As light can be transmitted at right angles, so can heat.
4. There are some bodies as transparent to heat as glass is to light; and others are as impervious to heat as an opaque substance is to light.
5. Flame exerts in heat a quality exactly similar to light for colour.
6. The law of the reflection of light and heat are analogous.
7. Heat, like light, can be polarized; which experiment, and several others of a most interesting character, the Professor took great pains (many of the experiments requiring much patience and great nicety of manipulation) to show to those of his class, either amateurs or professional pupils, who were interested in the subject.
8. The laws of light and heat are nearly identical.

CROSSKILL'S WHEEL NAVE.

[Registered under the Act for the Protection of Articles of Utility. William Crosskill, of the Beverly Iron Works, Wheel Manufacturer, Proprietor.]

Fig. 1. Fig. 2.



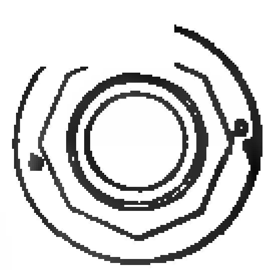


Fig. 1 of the above engravings is a longitudinal section of this nave with a portion of the axle inserted in it. Fig. 2 is a cross-section of the nave. AA is the outer shell, which is of a spherical form; BB (fig 2) are the mortices or recesses for the spokes B^1B^1; C is the axle, to which the wheel is secured by means of a nut D screwed upon the back of the nave; and E is a cap screwed upon the outer end of the nave, which serves to retain oil in the cavity, FF, for lubricating the axle. A small channel, indicated by dotted lines, is cut along the axle to allow the oil to arrive at its further end, where there is another cavity, GG, for

retaining oil; H, H, H, are leather discs, and I a pin for filling a hole by which the cavity, FF, is filled with oil.

By the judicious arrangements adopted in this nave, these advantages are secured—first, the oil is prevented from escaping; and, second, the wheel is secured upon the axle without either linch or screw-pin.

SUBMARINE NAVIGATION.

The following paragraphs, which are going the round of the newspapers, have reference apparently to one and the same project; and that seems to be a resuscitation of Dr. Payerne's, which, some years ago, occupied a good deal of the attention of the London public—(*See Mech. Mag.*, vol. xl., p. 1—7):—

A New Submarine Boat.—The *Debats* states that there has been constructed, at the establishment of Creusot, a boat on a new plan, which realizes the great problem of submarine navigation. The size of the boat and its machines are such, that it will not be confined to the execution of works under water, such as have recently taken place at Brest, and in the Seine at Paris. The new boat is to come by the river from Creusot to Paris, and is to proceed to Calais by means of its own engines, which are on the screw principle. At Calais it is to be plunged under water, and is to proceed (under water) to Dover, where it is expected to arrive in a few hours. From Dover it is to ascend the Thames to London, to figure in the Grand Exhibition.—*Galignani's Messenger.*

Plan of Submarine Steam Navigation.—Dr. Payerne has constructed a submarine iron boat, on the screw principle, measuring 27 feet long and 9½ feet wide, which, according to M. Lamiral, his manager, perfectly accomplishes the purpose for which it was intended, by the following means:—1. Alimentation of vital air constantly made under water without any communication with the atmosphere above water. —2. Direct contact of the screw with the water at any depth, down to 150 feet.—3. Slow or active locomotion of the boat under water. The alimentation of air is made by a double process, mechanical and chemical, which maintains, almost without expense, the air perfectly pure and respirable in all hermetical places, such as diving bells, submarine vessels, ships' holds, mines, &c. The direct contact with water is easily obtained by a pressure of air, previously stored in special compartments of the boat, and let out into the room, where the bottom of the vessel is to be thrown open, with a tension made sufficient to balance the column of water, and the weight of the atmosphere above. A slow locomotion under water is necessary to accomplish various branches of industry, such as saving wrecked goods, fishing for corals, pearls, &c., mining and blasting away rocks or masonry, concrete works, erecting foundations of piers, quays, lighthouses, &c. In these cases, when the submarine boat has dived down to the bottom, the crew work her as if preparing to go up, pumping out the liquid ballast, in order to render the specific gravity of the submarine boat nearly equal to the weight of the bulk of water that she displaces. Then, previously to the natural ascending impulse which would take place, a couple of men, having their feet on the ground, and the upper part of their body inside of the boat, take hold of her, and walk easily towards the point wished for. This slow ambulation is quite sufficient in the above-mentioned works. A rapid locomotion for travelling the boat under water, and for contending against under-currents, must be given by steam power. The apparent impossibility of maintaining under water a furnace with a current of air, is completely conquered by chemistry, in its pyrotechnical branch; a certain fuel is consumed in an hermetical furnace, and generates steam in the boilers. The machinery is worked quite as well as in any other screw-steamer. The important attainment of Dr. Payerne cost him ten years of persevering study, the loss of his health, and of large sums of money. After stating that favourable reports of this invention have been made by some of the most eminent men of science, and that the Minister of Public Works has appointed a commission to report upon it, M. Lamiral adds, that Dr. Payerne's boat is to be sent to Cherbourg to blast some rocks.

The attempt of Dr. Payerne recalls to recollection the *bateau plongeur* of the celebrated Fulton, of which the following account is given in the Memoirs of his friend, Dr. Cartwright, the inventor of the power loom:—

Extract Letter from Fulton, dated March 28, 1802.

"For political reasons, I have never yet confided to *but one person* the combination of my plunging-boat, and committed the whole to drawing and explanations, in case of any accident happening to me; however, it will be satisfactory to you to know that the experiments have been very successful. I was very fortunate in surmounting some great difficulties; and *navigating under*

water is now easy to be performed, and without risk."

In the "Annual Register" for 1802, is an account of Mr. Fulton's diving-boat, taken from the relation of citizen St. Aubin, a man of letters at Paris, and member of the Tribunate, which confirms the inventor's own statement of the success of his experiment. "I have," says Monsieur St. Aubin, "just been to inspect the plan and section of a nautilus, or diving-boat, invented by Mr. Fulton, similar to that with which he lately made his curious and interesting experiment at Havre and at Brest. The diving-boat, in the construction of which he is now employed, will be capacious enough to contain eight men, and provision enough for twenty days, and will be of sufficient strength and power to enable him to plunge 100 feet under water, if necessary. He has constructed a reservoir for air, which will enable eight men to remain under water for eight hours. When the boat is above water, it has two sails, and looks just like a common boat. When she is to dive, the mast and sails are struck. In making his experiment at Havre, *Mr. Fulton not only remained a whole hour under water, with three of his companions, but kept his boat parallel to the horizon at any given depth.* He proved that the compass points as correctly under water as on the surface; and that, while under water, the boat made way at the rate of half a league an hour, by means constructed for that purpose."—Vol. xliv.

Whatever might be the ingenuity of the contrivance, or merit when effected, of the *bateau plongeur*, it is certain that Earl Stanhope, no incompetent judge of mechanical and scientific subjects, entertained a formidable idea of its efficiency, and earnestly endeavoured to impress upon the English Government a sense of the danger that might arise to this country, in consequence of the French nation having taken the American, Mr. Fulton, under their protection. In the following year (1803) his Lordship again referred to Mr. Fulton's contrivance for blowing-up ships under water, and stated in the House of Lords that he had himself given a plan to the Admiralty, for preventing the effect of an invention, which he considered of so formidable a nature.

It is evident that the art of navigating under water might convey an awful power into the hands of any one who possessed it; and consequently the British ministry did not think it unworthy of inquiry how far Mr. Fulton's pretension to success, in so formidable an art, was well founded or not. Mr. Cartwright, who was probably in full possession of Mr. Fulton's secret, and no less impressed than Earl Stanhope with the notions of its dangerous extent, was consulted in this inquiry. On the renewal of the war, Mr. Fulton's neutrality, at least, was considered worth the purchase; and Mr. Cartwright was appointed one of the arbitrators to settle the terms upon which Mr. Fulton consented to the suppression of his secret. The terms of the award were probably satisfactory to Mr. Fulton. He returned to America not long after the arrangement alluded to, and in the following summer (1807) he had the satisfaction of seeing accomplished his long-cherished and favourite project of launching a steam-boat in his native country. As Mr. Fulton's name is introduced into this memoir solely with a reference to his intimacy with Mr. Cartwright, it is not necessary to enter more at length into the question of the extent to which he might, or might not, have availed himself of the inventions of others. It is certain that he owed much to his own ingenuity for the success that attended his first experiment at New York; and still more to that activity of mind and spirit of enterprise, which enabled him so to establish steam navigation in America, that its obvious advantages there should have led to its extended adoption, not only in this country, but in every part of the civilized world.

THE ELECTRIC CLOCK OF THE GREAT EXHIBITION.

Hitherto, in the application of electro-magnetism as a maintaining power for clocks, the attractive and repulsive forces of the magnets have been brought to bear directly on the pendulum, which has proved fatal to the accuracy of the performance. In the most successful arrangements attempted permanent magnets have been employed—one on either side the pendulum bob; while the bob itself consists of a coil of insulated wire, through which the electric fluid is transmitted at intervals. During the transmission of the electric current, the pendulum, by its influence, is deflected or attracted on one side, by an amount of force varying, in all cases, according to the power of the galvanic current and the influence of the permanent magnets. By the attractive force thus induced, the pendulum is deflected, so as to produce its oscillation; and during such oscillation a pin, projecting from the pendulum-rod, by its motion comes in contact with a transverse sliding bar, which forms a link in the electric circuit. This bar is slid in the direction of its length, and rests upon two points, which, during the completion of the circuit, are in contact

with conducting surfaces. The pendulum having been attracted, as described, moves through a given distance, when contact of the pin with the break-bar takes place, and moves it sufficiently to carry its point of support beyond the conducting surfaces on which it rests, thereby breaking contact, suspending the current, and leaving the pendulum free to perform the opposite oscillation. The maintaining power of electric clocks hitherto has been the same as that transmitted to the pendulum, the latter being employed to communicate power to the escape-wheel, and thence through the train of wheels to the clock. But in electric clocks the amount of power will be effected by the quantity of electricity passing, and as it is impossible to obtain batteries of never-varying power, any and every variation therein will be communicated directly to the pendulum. This power is also applied at a point where the instrument is most sensitive, and easily susceptible of any disturbing influence in its otherwise isochronous movements.

Mr. Shepherd, of Leadenhall-street, has now patented an arrangement for securing perfect regularity in the oscillation of the pendulum, by which complete accuracy is obtained in electric time-keepers for any lengthened period. The Royal Commissioners for the Great Exhibition have granted permission for one of these clocks to be placed in the south end of the transept of the building.

Instead of transmitting the necessary power or impulse to the pendulum through the train, Mr. Shepherd applies the power of a spring, wound up to a given extent at each oscillation of the pendulum, precisely on the principle of the "remontoir" escapement. By this simple arrangement, the most unerring precision is obtained for any length of time, with this further advantage, that this escapement is perfectly independent of the motion given to the wheels, and, therefore, not subject to any irregularity which may exist in them. The oscillations are thus free from any casualty liable to disturb the motion—the influence of the pendulum on the motion of the clock being confined simply to making and breaking the circuits; and to this freedom of motion is to be ascribed the correct performance of the instrument.

Eight electro-magnets are employed in the clock for the transept of the Exhibition Building, each composed of charcoal iron three-quarters of an inch square; on each leg of every magnet is a brass reel, covered with 1500 feet of isolated copper wire, or or 25,000 feet in all, weighing about 1½ cwt. The twelve hours of the day are arranged in a semicircle; and the dial has been made in that shape accordingly, as a circular one would have disfigured the architectural beauty of the building. The figures are arranged in spaces left at the intersection of the second semicircular rib from the centre, with the radial bars of the fan.

In order to indicate the time on a semicircular dial throughout the twenty-four hours, it was necessary that each hand should rotate on its centre, each end forming a separate hand. The minute hand revolves once in two hours, and as one end leaves the hour VI. on the right of the dial, the other commences at VI. on the left. The hour hand is similarly constructed, one end being on the dial from six in the morning to six in the evening, when the other takes its place. The minute hand is 16 feet long, the hour hand 12 feet. The framing of the motion work is of cast iron, with gun-metal bosses to receive the pivots; the arbor of the large wheel projects through the frame, and carries a vertically-bevelled wheel 12 inches in diameter, which takes into a horizontal bevel of the same size, and from the arbor the motion is carried up to the hands, by a rod composed of lengths of brass tubing screwed together. This clock, although equal in power to that of St. Paul's, occupies far less space, and the heavy weights, with the room necessary for their descent, is entirely dispensed with.

In addition to the large dial there will be two smaller ones, each 5 feet diameter, one of which will be placed in front of the galleries, and all worked by the same pendulum.

STEAMBOATS AND LIGHTNING STORMS.

A correspondent of the (American) *Farmer and Mechanic* makes the following inquiry:—

"*Have you ever known, either personally, or on good authority, that a steam-boat has been struck with lightning? If not, and a* STEAM-BOAT IS A NON-CONDUCTOR, *please note the fact and explain the reasons.*"

Mr. Meriam, a well-known observer of meteorological phenomena, makes the following answer to this inquiry:—

Steam-boats are not wholly exempt from lightning visitations. My register of lightning disasters, which is very extensive and very minute, containing about 1,500 cases of destruction and damage by lightning, embraces in this formidable catalogue but ten cases of steam-boats struck by lightning, and in none of these has loss of human life resulted from the lightning, and in but one of the ten cases was the electric shock felt by persons on board, and in that case a person

was severely stunned on board a steam-boat on the Ohio river, near Louisville.

The account was published in the *Louisville Kentucky Penant* of April 24, 1843, as follows:—"As the *Joan of Arc* was descending the river between this place and Cincinnati, during the storm of Saturday night, the captain, who was giving orders to land the boat, was struck senseless by a flash of lightning, and fell on the lower guards. He remained insensible until yesterday morning, but finally recovered. No one else was hurt, or damage done to the boat."

A steam-boat (it is stated in the newspapers) was struck by lightning on the 2nd of June, instant, at St. Louis, Missouri, during a thunder storm, the lightning of which struck nine or ten houses in the same vicinity. The amount of damage is not stated. On the 23rd of February, 1848, two steam tow boats were struck by lightning at south west pass of the Mississippi during a fearful and terrific lightning tempest, accompanied by a hail-storm; damage trifling. On the 1st of August, 1846, the steam-boat *Citizen*, in the river Thames, below London, was struck by lightning while in rapid motion, and one of her boxes over one of her paddle-wheels was injured. The boat was enveloped in a blaze of lightning for a moment. It was a terrific thunder and lightning storm, and lasted two hours at London, and at Liverpool the rain fell 4½ inches.

The other five cases mentioned in my register occurred at periods far apart, on the lakes and rivers of the United States.

PARKINSON'S WATER METER.

A paper on this water meter (fully described in this Journal, vol. li., p. 289) was read at the last Meeting of the Institution of Mechanical Engineers, upon which

Mr. Clift observed, that he had carefully tested this meter, and found that it measured liquids very accurately, and, indeed, small quantities were measured by it more accurately than could be effected by pouring from one vessel into another. It was a very ingenious contrivance, for the valve took off the pressure and allowed the meter to work with a heavy pressure exactly the same as with the small pressure. Meters had heretofore been made to work under pressure, but it became impracticable to use them for common purposes, in consequence of their great expense, caused by the strength necessary to stand the heavy pressure. This meter was placed at the top of the building, and registered the water that passed down to supply the house; the cistern below was always kept full, and not more than full, in consequence of the float-valve, which stopped off the supply when the water was not being used. He had been informed by Mr. Parkinson (who was unable to attend the present meeting), that he had so many applications for these meters from different Water Works Companies that he could not supply them fast enough. The Sanitary Commissioners had recommended the employment of meters for the supply of water to all small houses in large towns, as the small consumers were at present supplied at a higher rate than others; and it was probable that some meter would ultimately be adopted by all Water Companies.

The Chairman thought it very likely that this plan of measuring water would be very useful, and a meter was much wanted, particularly to those who purchase large quantities of water, as was the case for railway purposes where there was only the imperfect means of measurement into tanks, for ascertaining the quantity consumed.

ELECTRO-MAGNETIC POWER.

We learn that Professor Page, who recently obtained from Congress an appropriation of 20,000 dollars to enable him to continue his experiments in testing, in Washington City, the applicability of the electro-magnetic power to machinery, has constructed an engine by which a cylinder printing-press is driven as well as if steam was the moving power. It is thought, however, by those who have witnessed the experiments of Professor Page, that though the power which he has arranged will answer very well in cases where motive power is only wanted in small quantities and on rapid calls, it never can come in competition with steam as a propelling power, for boats, cars, &c., &c. Others look to the experiments now in progress for more satisfactory results.

At a recent lecture at Washington, Professor Page exhibited his trip-hammer, in which he raised up and suspended an immense bar of iron, weighing 50 pounds, which produced a jarring of the whole room as it fell. Heavy blows were made in rapid succession, but the motions of the bar were so easily controlled that it was laid down slowly or rapidly at pleasure.—(*American*) *Farmer and Mechanic.*

THE ELECTRIC TELEGRAPH IN MEXICO.

A contract has been entered into by the Mexican Government with Wm. George Stewart, Esq., the Mexican Consul at New York, and Senor Juan de la Granja, of

Mexico, to construct a line from Vera Cruz to the City of Mexico—a distance of three hundred miles—on the understanding that it will be in operation by the 1st of May next, as far as El Ojo de Agua, a distance of 120 miles from the latter place. Another line will soon after be built between Acapulco and the City of Mexico. When both are completed, there will be magnetic communication between the Atlantic and the Pacific. —*Scientific American.*

CUNNINGHAM'S REEFING APPARATUS.

"The *Iberia* will take out the next Peninsular Mails. This ship is fitted with Cunningham's Patent Topsail, which reefs itself. During the last voyage of the *Iberia* she suffered very heavy weather, when the experiment was put to a severe test, and found to answer admirably, the officer of the watch taking in the reefs at discretion, *by himself,* from a first reef to a close reef, without sending a man aloft. This is the second voyage in which this extraordinary invention has been tested. A slight alteration has now been made in the hoisting part, so that three or four persons can hoist the sail, which is of the size adapted for a *sailing* ship of 300 tons. The simplicity of this invention is its greatest recommendation; it can be fitted to any sized ship, from a first-rate downwards; will be a great desideratum in the coasting trade, and a boon to the mercantile navy in general, where economy of labour is so desirable to enable the British shipowner to compete with the foreigner."—*Globe.*

On Impossible Equations.

Sir,—I beg that your readers will make the following corrections in my Note (*sup.* p. 185) to the last portion of Mr. Harley's paper:—

Line 4. *For* 491 – 12 *read* 491 – 492.

Line 5 (from the bottom of the Note), *For* same *read* sign.

Line 10 (from the bottom of the Note), *After* quadratic *read* is negative.

I am, Sir, yours, &c.,
JAMES COCKLE.

Lincoln, March 10, 1851.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MARCH 13, 1851.

ANDREW BARCLAY, OF KILMARNOCK, AYR, engineer. *For improvements in the smelting of iron and other ores, and in the manufacture or working of iron and other metals, and in certain rotary engines and fans, machinery or apparatus as connected therewith.* Patent dated September 5, 1850.

The present improvements relate—1. To blast furnaces, of which Mr. Barclay describes three different arrangements. In the first of these the furnace which may be circular or of any other suitable internal shape, is provided with three tuyeres communicating by vertical branches with the main cold air pipe. Each of the tuyeres has a triple branch, furnished with suitable stopcocks, one pipe of which opens into the small end of a bell-shaped chamber forming part of the furnace, while the other two communicate with it at the sides near its junction with the body of the furnace. The exit orifices of these latter are also bell-shaped, for the purpose of equally diffusing the blast. Each chamber has also a charging tube closed by a double door to admit of the introduction of fuel, while the blast is on. In working with this furnace, fuel and carbonaceous matter are introduced into the chambers in addition to the charge of ores, fluxes and fuel in the body of the furnace; the blast is then turned on at each central pipe, so that the fuel is speedily ignited; but as the air, which has passed through the incandescent fuel becomes too much deoxidized, more oxygen requires to be supplied, and this is done by turning on the blast through the side pipes of each chamber, the air thus admitted, although in a heated state, containing a greater proportion of oxygen than that which had passed through the fire. To obviate the objection that the heat is unequally diffused in different parts of the furnace, additional tuyeres may be provided, situated at suitable heights and the same furnace will be thus rendered capable of performing the double operation of "combining and separating." In the second arrangement, there are also three tuyeres, the blast pipe in communication with each of which terminates in a forked branch. One arm of this branch serves for admitting air above the burning fuel, while the other conducts the blast beneath the grate bars and through the fire in the chambers to the body of the furnace. A similar result is obtained in the third construction, in which two tuyeres are employed. In every case the blast can be so regulated as to vary the quantity of oxygen contained in it according to circumstances, and the quality of iron desired to be produced. When the produce of the furnace is desired to be converted at once into malleable iron, it is run into ladles at the proper time for charging the puddling furnaces, and poured into the latter in a melted state, thus economising time, labour, and expense; when both combining and separating furnaces are employed, the iron is removed from the former to the latter, in a fluid, or red-hot state, with the addition, at the same time of a sufficient quantity of carbonaceous matter. It is considered desirable, when working furnaces according to this arrangement, to place them on sloping ground, the operations being facilitated by having the floor of the one furnace at a higher level than the charging door of that lastly employed.

2. To an improved construction of blower

in which the blast is produced by the direct pressure of steam. This blower consists of one or two vertical cylinders or receivers, which communicate near the top with the pipe for supplying steam at a proper pressure, and have also near the top a clack valve opening inwards for admitting air. At the bottom of each cylinder is a water jet, a small aperture for the escape of steam, and a pipe leading to the tuyeres. The action of the blower is as follows:—Air is admitted by the clack valve till the cylinder is filled, the steam is then turned on, and as the induction-pipe terminates inside the cylinders, with a funnel-shaped mouth opening upwards, the pressure of the steam against the clack valve at once closes it, and the steam continues to rush in until all the air is expelled. As soon as this takes place, and the steam begins to escape from the before-named aperture, a jet of water is thrown in, by which the steam is condensed, and air again immediately enters and fills the cylinder, when the preceding action of the appatus is repeated. The stop-cocks are opened and closed by any suitable mechanical contrivance.

3. To an improved rotary engine of the emission, or reaction class. The casing of this engine, within which the steam arms revolve, is supported in a suitable framing immediately over the boiler, the hollow spindle being placed vertically and in immediate connection with the steam pipe. In the interior of the case is a circle of guide or division pieces, about half an inch apart, and tangential to the centre of the exit orifices of the emission arms on the revolving spindle. The case is much larger in diameter than the circle formed by the outer edges of the guide pieces, so that a clear passage is left all round for the escape of the steam to the waste-pipe. By this arrangement no rebounding of the steam can take place so as to offer any resistance to the revolution of the arms, the steam passing off at once between the plates to the waste-pipe; and by proportioning the weight of the moving parts to the upward pressure of the steam, the friction will be reduced to a minimum.

4. To a fan of peculiar construction, which is shown as being worked in connection with the last-described engine, the high speed of which renders it peculiarly adapted to this purpose. It is mounted on the same spindle as the hollow arms in a casing placed above that in which the arms revolve, the spindle passing through suitable stuffing-box in the lid of the case to admit of this arrangement. The blades of this fan are in the form of an obtuse angle, the hollow part being the impelling surface. By admitting steam at the blast-pipe, so as to act against the hollow of the blades, this fan may be employed as a rotary engine of the impulsive class.

Claims. — 1. The system of blowing smelting or melting furnaces by separate and distinct air blasts, combined and applied in the furnace, or its fuel-heating chambers.

2. The use or employment of compound tuyeres for the purpose above set forth.

3. The employment of fuel-heating chambers, forming in themselves parts of the furnace.

4. The application of tuyeres for simple or combined air and vapour blasts, for the supply of air or vapour at points above the level of the ordinary or bottom tuyeres.

5. The mode of charging fuel and carbonaceous matters at the bottom of the furnace, or at any suitable point below the ordinary charging doors.

6. The use of an escape-valve for the gases or vapours produced by the combustion of raw or green coal where supplied at the bottom of the furnace.

7. The smelting of ores by two operations, whether performed in two seperate furnaces, or by the use of upper and lower tuyeres in the same furnace.

8. The use of blowers in which the direct pressure of steam is employed to expel the blast of air from the cylinder or receiver.

9. The application of guide or division pieces within the cases of rotary engines of the omission or reaction class for the purpose set forth.

10. The system or mode of working emission, reaction, or impulsive rotary engines and fans on the same vertical spindle.

11. The use of rotary engines and fans with angular blades as above described.

John Beattie, of Liverpool, engineer. *For certain improvements in steering vessels.* Patent dated September 5th, 1850.

The improvements here claimed consist in forming the rudder and rudder-post of screw-propelled vessels so as to admit of the screw or spiral propeller being attached to its shaft behind the rudder, instead of between it and the deadwood. The rudder is thus divided into two parts, one above and the other below the propeller shaft—both being firmly secured to the rudder-post, and the whole encircled by a metal framing, in which is formed the bearing for the shaft and rudder-post. In order to admit of the rudder being put up or down, as occasion may require, the orifice in the rudder-post, through which the propeller shaft passes, is laterally widened.

William Erskine Cochrane, of Cambridge-terrace, Regent's-park, and Henry Francis, of Princes-street, Rotherhithe.

For improvements in propelling, steering, and ballasting vessels, in the pistons of steam engines, in fire-bars of furnaces, and in sleepers of railways. Patent dated September 5, 1850.

1. The "improvements in propelling" consist in employing for that purpose one or more oar-shaped blades, suspended from each side of the vessel, and to which an oscillating motion towards and from the sides is imparted. The blades are suspended so as to have the power of canting or feathering in the return stroke.

2. Under the head of "improvements in steering," two arrangements are described. In the first of these—which is applicable to vessels of ordinary build and those propelled by paddle-wheels, or other midship propellers—the rudder is formed with a pivot, which rests in a strong metal bracket secured to the stern-post or to the keel, which must be made to project sufficiently for that purpose. The upper part of the rudder-shaft passes through two bearings formed in the stern, and is provided with a tiller in the ordinary manner. In the second arrangement—which is adapted to stern-propelled vessels—two rudders of peculiar shape are employed, which are placed under the quarter one on each side. They are connected with each other on deck, so as to be worked simultaneously.

3. The improvements in "ballasting" relate to colliers, and consist in forming in the hold two iron tanks or bunkers, one on each side of the keel. When ballast is required, these tanks are filled with water; at other times they may be employed to hold coals.

4. The improvements in "pistons" consist in forming the packing-rings with internal radial projections, from every alternate one of which the inner part is cut out, and a certain amount of elasticity thus obtained. Clamps are then applied to those projections, from which the interior has been cut out, and they are compressed till the edges meet at the circumference, when the rings are turned to the proper size, and the clamps removed. In applying these rings, the projecting parts are made to break joint with each other, the hollow portions of one ring being placed over the solid parts of the other. In order to prevent their shifting, one of the rings has a small pin, which takes into a corresponding recess in the other one.

5. The improved "furnace-bars" are formed of a V, or U, or gutter shape, either wrought or cast, and the hollow space is filled with fire-clay mixed with a certain quantity of sand or ground fire-brick, to prevent its shrinking, or with a fire-brick of the exact required size.

6. The improved "sleeper" consists of a basement-plate, on which are formed longitudinal ribs, with recesses to admit the feet of the chairs, which are kept in position by a block of wood placed between them. The rail rests on this block, and is secured to the chairs by wedges or keys.

James Rennie, of Falkirk, gentleman. *For a certain improvement or improvements in the construction of gas retorts and furnaces, and in apparatus or machinery applicable to the same.* Patent dated September 5, 1850.

The first of these improvements consists in an arrangement of apparatus by which the retort or retorts are connected with the furnace-door in such manner that the opening or closing, or motion of the latter on its hinges, shall cause the retort or retorts to make a partial revolution, thus bringing every part of the charge under the more immediate action of the fire, and at the same time equalizing the wear of the retorts.

The retorts are formed of clay, but terminate at the inner end in a short metal shaft, which is supported in a plummer block capable of sliding up and down to admit of the retort being adjusted to its level, or, if desired, removed altogether from the furnace. The necks of the retorts are also formed of metal, and have their bearings in plates attached to the front of the setting. The vertical pipe leading to the hydraulic main is connected to the retort by a ball and socket joint, and has also a second similar joint to admit of its being moved aside when charging the retort. On the lid are formed a ring of teeth, into which gears a paul on the end of a lever supported in a suitable framing, and connected by rods with the furnace-door, so that when the latter is opened by raising the lever, the paul takes into the teeth on the lid of the retort, and causes it to turn. When more than one retort is used, the teeth are made to gear into each other, so that the revolving motion may be simultaneous.

A second improvement consists in lining the interior of the furnace with ashes, or some other bad conducting substance.

John Saul, of Manchester, cotton spinner. *For certain improvements in machinery or apparatus for spinning and twisting cotton and other fibrous substances.* Patent dated September 5, 1850.

These improvements relate to throstle spinning and doubling machinery, and especially to a particular arrangement of the spindle and flyer, for which a patent was granted to H. Gore, of Manchester, in 1831, known as "Gore's tube spindle." Mr. Saul applies a loose tube between the fixed or steadying tube and the bobbin, the lower

bush of which is thus kept from contact with the fixed tube and the intense friction which has hitherto taken place between the bobbin and the fixed tube is transferred to the loose tube, where it is capable of being regulated by applying washers of leather or cloth above and below a flange on the lower part of the tube. According to this arrangement threads of a much higher number or finer quality may be spun than in machines of the ordinary description. In spinning fine threads, it is preferred to attach a fly-wheel to each throstle-frame to regulate the starting and stopping of the machine, and prevent the bobbins from overrunning.

Claim.—The application of a loose tube between the fixed or steadying (Gore's) tube and the spindle.

JAMES MATHER, the younger, of Crow Oaks, Pilkington, Lancaster, bleacher, and THOMAS EDMESTON, of the same place, calenderman. *For certain improvements in machinery or apparatus for scouring, finishing, and stretching woollen, cotton, and other woven fabrics.* Patent dated September 5, 1850.

The main feature of these improvements, and what is specially claimed by the patentees, is the application of a roller or other surface pressing upon the material under operation, and travelling in the direction of its width. This arrangement of apparatus is applicable not only for giving what is termed the "beetle" or linen finish, to cotton cloth, but also for "fulling" and scouring woollen fabrics, which, as in the former case, are "stretched" in the direction of their width by the pressure of the roller.

CHRISTOPHER CROSS, of Farnworth, near Boston, cotton spinner and manufacturer. *For certain improvements in the manufacture of textile fabrics; also in the manufacture of wearing apparel and other articles from textile materials, and in the machinery or apparatus for effecting the same.* Patent dated September 5, 1850.

1. Under that portion of his invention which relates to looms for weaving, Mr. Cross claims—1. The employment of a temple composed of an endless travelling chain, with points so arranged as to draw the cloth outwards, at the same time presenting a flattened surface of the said chain thereto. 2. So constructing the reeds of looms that the dents may be shifted nearer to or further from each other, or a portion of them removed for the substitution of others. 3. The production of dividing strips of calico or other cloth simultaneously with the weaving of fustian, by the application of a shedding motion, distinct from that which operates upon the warp threads of the fustian.

2. With regard to the improvements in the manufacture of articles of wearing apparel, and sacks or bags of irregular figure, the claims are for producing different shapes—1. By governing the action of the warp threads by the agency of a Jacquard or other suitable apparatus, so that a portion of the threads, as occasion may require, shall be prevented from the usual action of shedding, so as to fail in combining with the weft, although the shuttle shall travel across the loom from box to box, thus producing an irregular quantity of work in the direction of the width of the loom. 2. By arranging the warp so as to be capable of producing two or more pieces of cloth, the whole width of the warp thread, and uniting certain of the respective threads of such otherwise separate pieces of cloth by means of a Jacquard or other apparatus, so as to give the desired shape. 3. By arranging the warp threads so as to produce two or more distinct pieces of cloth, and causing the weft to traverse them separately, or to unite two or more of them. 4. By causing the dents of the reed to expand or contract, so as to cause the warp threads to occupy a space of variable width. 5. By the employment of a sliding-plate which, by selecting certain of the warp threads, prevents them from being shed by the action of the shafts, or which combines certain of them, in order to effect the required stitching. 6. By the use of an arrangement of Jacquard apparatus consisting of a row or rows of needles capable of being shifted, so as to act in combination with different portions of the chain of cards or plates.

FREDERICK WOODBRIDGE, of Old Gravel-lane, engineer. *For improvements in machinery for manufacturing rivets, bolts, and screw blanks.* Patent dated September 5, 1850.

In this machine the dies are arranged at equidistant intervals on two discs, which are caused to make a series of partial revolutions, and maintained in position while the dies are in action by a lever, which takes into a notch on the surface. The heading dies are carried loosely by one of the discs, and receive pressure from a sliding piston. The rod of iron of which the articles are to be formed is fed into the machine between two rollers, and rests in a gutter, which also acts as a cutter when the die disc is set in motion. The die disc revolves in a trough of water, through which each die, after having been used, has to pass before it again comes into operation.

Claim.—Combining mechanical parts into a machine for forming rivets, bolts, and screw blanks.

GEORGE SMITH, of Manchester, engineer.

For certain improvements in steam engines, and also improvements in feeding or supplying the boilers of the same; part or parts of which improvements are also applicable to other similar purposes. Patent dated September 5, 1850.

1. Mr. Smith's improvements in steam engines consist in admitting cold water into the exhaust pipes as near as possible to the nozzle of the cylinders, the steam thus condensed being drawn off by the feed pump along with the water employed for condensation, and returned to the boiler, while the uncondensed steam passes to the condenser as usual.

2. For supplying water to low-pressure boilers, Mr. Smith connects a valve in the feed pipe with a float in the interior of the boiler. The sinking of the float brings an eccentric into operation, which raises the valve and admits water. At the same time that the float falls it carries with it a lever, which allows the escape of steam through a whistle of peculiar construction, thus giving a warning to the engineer. Should the float fall still lower, the lever in connection with it raises a valve in the lower portion of the boiler, and allows the water to rush out through a pipe leading to the fire-place, for the purpose of extinguishing the fire.

3. Two constructions of pump are described—viz., a hot-water, and an air or lifting pump. The former of these has an aperture near the top of the barrel for the escape of steam and hot air. The plunger of the lifting pump works in a stuffing-box in the bottom of the barrel.

4. Mr. Smith describes two different constructions of metallic packing. In the first of these the spring is made of greater thickness at the part opposite to the divisional opening, and externally eccentric at that point by the amount of increased thickness. The packing rings are internally concentric with the exterior of the spring, and externally with the interior of the cylinder or pump-barrel. By this arrangement, the expansion is equal in every direction. For contracting the packing to admit of the piston being readily inserted in its cylinder, each end of the spring is formed with a flange radiating towards the centre, against one of which an eccentric is caused to act by turning a wormed spindle, so as to bring the ends of the spring together, and thus effect the desired object. In the second arrangement, a partially grooved or double eccentric, consisting of two eccentrics united together at an angle, so as to leave a space between them at one part of their circumference, is employed to contract the spring; the two flanges at each end being held in the groove of the eccentric. When the spring has expanded to its fullest extent, it may be rendered available for further use, by turning the eccentric so as to bring the grooved part *between* the flanges on the ends of the spring, so as to force them apart, and cause the spring to expand.

William Watt, of Glasgow, manufacturing chemist. *For certain improvements applicable to inland navigation, which improvements, or parts thereof, are also applicable generally to raising, lowering, or transporting heavy bodies.* Patent dated September 5, 1850.

The improvements here claimed relate to the application of air by compression and exhaustion to working canal and other locks, raising and lowering vessels to and from different water levels, working graving docks, facilitating the entrance and exit of vessels into and from wet docks, loading and discharging vessels, and increasing their buoyancy in case of injury from leakage, &c.

Pierre Erard, of Paris. *For improvements in the construction of pianofortes.* Patent dated September 12, 1850.

Claims.—1. A peculiar construction of wrest plank, as applied to grand, square, and upright pianos, with vertical or oblique wires. The novelty of this wrest plank is, that its strength to resist the pull of the wires is derived from metal, and the wood which is applied thereto (when wood is applied at all) is only for the purpose of receiving the usual kind of wrest or tuning pin, when such are used; but the wrest plank may be made entirely of metal in cases where tuning screws constructed according to the second part of this invention are used either for a part or all of the wires of the instrument. Also a metallic bracing with two or more bars, as applied to upright pianos of any description.

2. A tuning screw, in which a distinct screw is employed for each wire.

3. A modification of Sebastian Erard's repetition grand pianoforte action applicable to upright pianos.

4. A new construction of pedal keys, with mechanism for establishing a communication between each pedal key and its corresponding finger key. This arrangement is an adaptation of the pedal-key principle of organs to pianofortes.

5. The combination of wrest plank wholly of metal with the tuning apparatus, having a distinct tuning screw for each wire, together with the metallic bracing, bracing bars, and a metal hitch-pin plate—the result of this arrangement being that the pull of the wire is almost wholly sustained by the metal framework, without any aid from the wooden portion of the instrument beyond just so much as is necessary to excite sonorous

vibration in the wooden bridge and sounding board.

On account of the expense of a complete set of tuning screws for each wire throughout the whole scale of the instrument, a short series of such distinct tuning screws may be applied to the wrest plank of metal only, for the wires at the lower or bass part of the scale, in which case as much wood must be applied to the metal wrest plank as will be sufficient to receive wrest pins or tuning pins for the several wires of the remaining upper part of the scale of the instrument.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, patent agent, for improvements in compressing air and gases for the purpose of obtaining motive power. (Being a communication.) March 10; six months.

Victor Hyacinthe Libert Guillouet, of Condé Sin Noirot Calvados, France, chemist, fer certain processes for increasing on manufactured fabrics the several shades of indigo. March 10; six months.

Elijah Galloway, of Southampton-buildings, Chancery-lane, Middlesex, civil engineer, for improvements in steam engines. March 10; six months.

Henry Alfred Jowett, of Sawley, near Derby, engineer, for improvements in railway breaks and carriages. March 10; six months.

George Robins Booth, of Portland-place, Wandsworth-road, Surrey, for improvements in generating and applying heat. March 10; six months.

James Murray, of Canterbury, Kent, barrack-master and captain, for improvements in saddlery and harness. March 10; six months.

Jean Baptiste Alphonse Brunet, of Paris, France, gentleman, for improvements in the manufacture of coverings for roofs, walls, partitions, furniture, and other similar articles, and in boxes, tubes, and other hollow articles, and in the preparation or manufacture of materials to be employed for such purposes, and also in machinery to be employed in such or similar manufactures. (Being a communication.) March 10; six months.

Thomas Horn, of Stanhope-street, May Fair, upholder and decorator, for machinery or apparatus for cleansing carpets, matting, and similar fabrics. March 10; six months.

George Roberts, of Selkirk, manufacturer, for an improved manufacture of certain yarns of linen, wool, silk, cotton, or other fibrous substances. March 10; six months.

William Galloway and John Galloway, of Manchester, engineer, for improvements in steam-engines and boilers. March 10; six months.

Jesse Ross, of Victoria-terrace, Keighley, York, gentleman, for certain improvements in machinery and other apparatus for combing wool, and other suitable fibrous substances and in applying or working the same. March 13; six months.

Thomas Dawson, of Milton-street, Euston-square, machinist, for an improved method of constructing umbrellas and parasols. March 13; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
March 6	2718	William Crosskill	Iron Works, Beverley	Wheel nave.
7	2719	Hilliard and Chapman	Glasgow	Table knife with invisible secured handle.
8	2720	William Merritt	Brompton	Painter's brush.
10	2721	A. D. V. Canavan	Wyndham-street, Bryanstone-sq	Buff bristles for cleaning and polishing brushes.
11	2722	I. Lusty	Liverpool	Pin and needle-case.
,,	2723	Wilson and Mathieson	Glasgow	The tourist's pocket umbrella.
12	2724	T. Bailey	Birmingham	Thumb latch.
,,	2725	J. De la Rue and Co.	Bunhill-row	Envelope letters.

CONTENTS OF THIS NUMBER.

Description of Fuller's Registered Landau—(*with engravings*) ... 201
The Education and Food Questions Considered in their Effects on Skilled Industry. By M. S. B. ... 202
On Mr. Frost's Supposed Discovery in Steam. By Ben. Cheverton, Esq. ... 205
Theory of Heat. By Arthur Trevelyan, Esq. .. 208
Description of Crosskill's Registered Wheel-Nave—(*with engravings*) ... 210
Submarine Navigation—Dr. Payerne's Project—Fulton's Experiments ... 211
Shepherd's Electric Clock ... 212
Steam-boats and Lightning Conductors ... 213
Parkinson's Water-meter ... 214
Electro-Magnetic Power.—Professor Page's Experiments ... 214
The Electric Telegraph in Mexico ... 214
Cunningham's Reefing Apparatus ... 215
Impossible Equations.—Notice of Errata in Mr. Harley's Paper ... 215
Specifications of English Patents Enrolled during the Week:—
Barclay ... Smelting ... 215
Beattie ... Steering ... 216
Cochran and Francis ... Propelling, &c ... 216
Rennie ... Gas Retorts ... 217
Saul ... Spinning ... 217
Mather and Edmeston ... Scouring, &c. ... 218
Cross ... Textile Fabrics .. 218
Woodbridge ... Rivets ... 218
Smith ... Steam Engines ... 218
Watt ... Inland Navigation ... 219
Erard ... Pianofortes ... 219
Weekly List of New English Patents ... 220
Weekly List of Designs for Articles of Utility Registered ... 220

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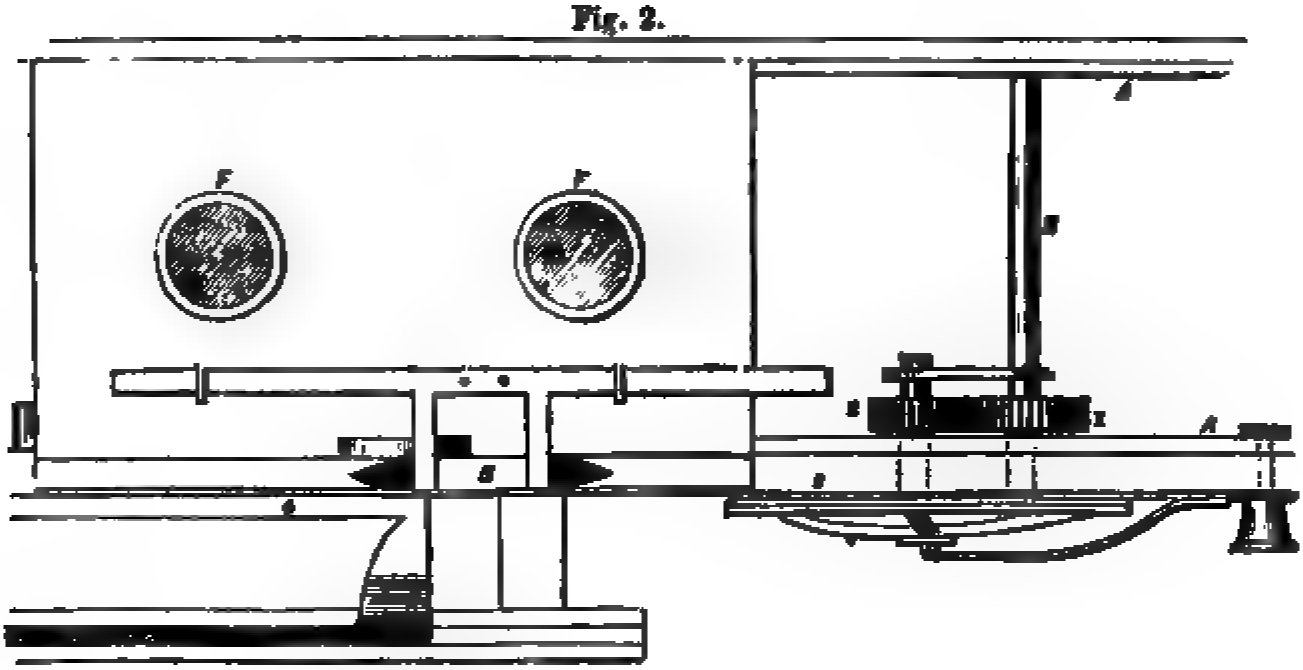
WILSON'S SEWING MACHINE.

Fig. 2.



WILSON'S SEWING MACHINE.

[AN English traveller, in the United States, writes to us from New York as follows:—" One of the newest and most ingenious things I have seen here, is a sewing machine, the invention of a Mr. Watson, of New Jersey. I send you some printed slips containing a full description of it." This description we now lay before our readers.]

The machine of Mr. Watson uses two threads to form the stitch, the one thread by a shuttle and the other by a needle—the motion of the two being regulated to form a lock-stitch, which will not rip out. It produces one stitch during the forward and another during the backward motion of the shuttle. The manner in which the cloth is fed-in to sew curved seams is beautiful.

Fig. 1 is a vertical transverse section; fig. 2 is part of a plan view; fig. 3 is a detached longitudinal vertical section. The same letters of reference indicate like parts. A is a long table, which supports the machinery; B is the bed plate, smoothed to fit into the table. There are two pillars FF, to support plates and shafts; G is a top plate, and H is an intermediate one; C is the main shaft, and D is a fly-wheel on it. E is a crank handle. There is a cylinder on the main shaft, having an eccentric groove in it (shown by the dotted lines.) This eccentric groove operates the forked arm M of the needle, which has pins in it inserted in the groove, which gives an out-and-in motion to the needle when the handle E is turned. On the other side of the fly-wheel there is a cam for operating the ratchet arm W, which has a pall on its lower end to take into a ratchet wheel on the spindle below, and turn it. P is a pinion on the small horizontal shaft, which is turned by a cog wheel on the main shaft above. L is a lever which hangs down to vibrate and operate the shuttle bar backwards and forwards. The spool is not seen, but the thread is shown passing behind the needle arm M. The needle is at the lower end. The shuttle 5 is like a weaver's, and is moved backwards and forwards, as on a loom. The bar on the plate, fig. 2, has two spring fingers embracing the shuttle in its raceway, and there is a pin on the inside of each finger. There are two pins on the bar above the shuttle, between which is embraced the vibrating lever L, fig. 1, therefore when the said lever is vibrated, the shuttle bar is moved backwards and forwards—once backwards and once forwards for every two stitches of the needle. The pins on the inside of the fingers must be lifted when the shuttle is passing through the loop G, fig. 1 (formed by the thread of the needle behind the cloth), and this is done by a projection on the plate, above the shuttle behind the fingers. Each finger is thrown out alternately, so that one holds the shuttle while the other is free, and thus the shuttle passes through the needle loop, forming the lock stitch. This is the way the shuttle is operated:—

The feed motion of the cloth to be sewed is peculiar—two circular plates being employed for that purpose (the edges of them only are seen in the figures). R is a spindle which carries a toothed wheel loose upon it, and there is a small spindle with a fast wheel 2, upon it. The outer end of this small spindle carries the flat round plate 3, which can be adjusted to different heights, to suit the sewing of large and small garments, &c. V is a circular plate, concave on the inside, and is of the same size as plate 3. The cloth is confined between these two plates, the concave parts allowing for the folds, so that any curved seam may be arranged on the periphery, packing the folds inside, and as these plates revolve, the needle passes through the cloth at the edge, and thus sews circular, or any kind of curved seam. In figs. 1 and 3 there is a spindle Y, with a pinion on it gearing into wheel 2. This spindle has a ratchet-wheel on it, which is operated by the ratchet-arm W, which is hung on a centre pin on the post X, and thus motion is given from the main-shaft above to the spindles Y and R below, to give the plates 3 and V a rotary motion to feed the cloth to the needle, and this is done at regular stitch distance for every stroke. For sewing straight seams, a different cloth holder is used, but this needs no explanation, such an arrangement being easily constructed. For sewing curved seams, it will easily be perceived how Mr. Watson had exercised a beautiful ingenuity. The one round plate being open concave, and the other flat, allows a seam of any curve to be arranged to the action of the needle, and the two plates are then pressed together by a spring on the bow-plate 4 (fig. 1), to hold the cloth snugly between the plates.

When the main shaft C is revolved, the needle arm is vibrated by the eccentric grooved cylinder; the cam works the ratchet arm W; the lever L gets its vibratory motion likewise from a crank pin on the spindle of the pinion P, which works in a slot in the lever,—and thus the vibratory and rotary motions to work the needle, shuttle, and revolving plates are derived from the main shaft C when the crank handle E is turned by the operator.

MR. RAWSON'S TREATISE ON THE SCREW PROPELLER.

Sir,—I have read in your valuable Journal (No. 1437), a review of my recent work on the "Screw Propeller." The strictures are characterised with a degree of severity, and I think of partiality, which claims my attention.

Whoever the writer of the article may be, such severity comes with a very bad grace from one who has fallen into the grievous error of confounding the direct force of the steam in the cylinder with the moment of force exerted to turn the screw round, seeing the latter is determined by the amount of leverage given to the crank of the screw shaft, and which may evidently be either great or small, irrespectively of the steam power shown by the indicator.

As to the surface of vanishing pressure, the remarks contained in your Journal agree in fact with my own—that a screw having arrived at that condition, cannot continue to propel the vessel, but that she would at once lose part of the velocity she had gained, till a pressure was again realised on the blades of the screw. But whilst it is evident that the writer understood such to be my view, *he* has supposed a case which we both agree to be an impossible one, and then has stated what would be the result if it were a fact!!! Nothing more, I presume, would be necessary on this part of the subject, as to the criticism; but I may venture to suppose that both yourself and very many of your readers would like to know what are really the views stated upon this condition of the action of the screw.

The three formulæ given on page 14 of my book, show the different conditions of the *surface of vanishing pressure.*

The first $n = \frac{102}{p} k$

„ second, $n = \frac{102}{p}(k - k')$

„ third, $n = \frac{102}{p}(k + k')$

n = the number of revolutions of screw per minute.
p = pitch of screw.
k = knots per hour (by the water.)
k' = knots per hour (by the water.)

The first expresses this condition when the water in which the screw works is still, with respect to the direction of the vessel's motion; the second expresses the same thing when the water in which the screw works has a velocity k' in the same direction with the axis of the screw propeller; and the third expresses the like condition, when the said water has a velocity k' in a direction opposite to that of the screw propeller. It is evident that all these states of the water may obtain in practice; but it is perhaps little less clear that the screw could not reach the surface of vanishing pressure in each of these states.

To deny that there is a surface of vanishing pressure would be too absurd for supposition, after due thought had been bestowed on the subject; and to deny that, in experience, difficulties have occurred which were inexplicable before the idea of a surface of vanishing pressure presented itself, would be to gainsay well attested facts. The difficulty was presented in the performance of the *Archimedes;* when it was observed, that with one of the screws under trial the distance passed over by the vessel in a given time, was greater than that measured by the pitch of the screw multiplied into the number of its revolutions in the same time. An hypothesis was then suggested to account for the phenomenon; but I believe the supposition was never deemed satisfactory, but the reverse; as screws including the condition referred to for the explanation, were found on more diversified experience, not the best with reference to the speed of the vessel and the slip of the screw.

It appears the most charitable supposition for me to entertain, that the writer of the article did not understand the three formulæ which I had given on this subject, and have quoted above; as he cautiously avoided any notice of them, and expressed opinions at variance with the conclusions to which the principles on which they have been formed would lead. Allow me, by way of illustration, to present the formulæ to your readers, with figures instead of indefinite symbols. Let the pitch of the screw be 15 ft., and the speed of the vessel 10 knots or nautical miles per hour; then the first formula would give $n = \frac{102 \times 10}{15} = 68$, the number of revolutions of the screw in

a minute which would place it on the surface of vanishing pressure, on which it would not continue to propel the vessel; if the screw made a greater number of revolutions than 68 per minute it would propel the vessel. This formula supposes it to be working in still water, a condition not very common in the use of this instrument; for the water, flowing into the immediate wake of the ship, produces a current in the direction of the ship's motion. This makes the second formula necessary. Now, suppose the current to flow into the immediate wake of the vessel at a velocity of two knots per hour; then $n = \frac{10}{15}(10-2) = 54{\cdot}4$, the number of revolutions of the screw in a minute, which, under such conditions of the water, with the other conditions unchanged, would place it on the surface of vanishing pressure.

Hence, while at a speed of 10 knots per hour, the screw working in still water, at 68 revolutions per minute, would have no pressure upon it to propel the vessel; it would, with the influx of water supposed, which I presume is not an excessive quantity, have a pressure corresponding to the difference of the two numbers (68 and 54·4), that is 13·6 revolutions a minute.

The part of the review which purports "to notice an error of a more serious kind, which Mr. Rawson has introduced into his fundamental equation, which runs through and vitiates all his speculations on the screw as a propelling power," may be briefly disposed of. The subject is "accelerated force;" and the reasoning on it is by no means clear; but, if as suggested, I simply put for n and m in all my equations, the values

$$\frac{k}{2\mathrm{I}} \text{ and } \frac{k'}{2\mathrm{I}}$$

respectively, I being the moment of inertia of a screw-blade, then all my equations will represent the results obtained by using $kf(v)$ the pressure on an element of surface of the screw blade; and $k'A''v^2$, the pressure on the bow of the vessel. Besides a want of clearness in the reasoning, it appears to me to be erroneous, inasmuch as, to fulfil the conditions assumed to make the equations

$$n = \frac{k}{2\mathrm{I}} \text{ and } m = \frac{k'}{2\mathrm{I}},$$

true, the pressures must be *abstract*, which they *are not*, instead of *fluid*, which they *are*. It is somewhat curious and interesting that the reviewer had not made himself acquainted with the report of the most exact and useful course of experiments undertaken for investigating the laws of the resistances of fluids. The names of d'Alembert, Condorcet, and Bossut, bespeak for the experiments some consideration, and the reputation of the Academy of Sciences at Paris, to which the Abbé Bossut's very elaborate report was presented, demands some respect for the conclusions to which those experiments led. One of those conclusions is as follows: "*That the resistances which arise from motion in oblique directions do not diminish, every thing else remaining the same, in proportion to the squares of the sines of the angles of incidence; therefore, on this third head, the common theory of the resistance of fluids should be abandoned altogether, when the angles of incidence are small, as then the results deduced from it would be very erroneous.*"*

The "significant error," which I unhappily fell into in constructing formula (3) under Prob. vii., page 21, consists in taking a certain number of units from another certain number of units. I cannot extenuate this otherwise than by saying it is an operation common to all mathematical processes. But I will just add that I do not suppose the Reviewer's remark about the greater of these numbers being "*a quantity of no dimensions*," will satisfy either the curiosity or the judgment of many who may seek amusement in trying to fathom his meaning.

I humbly venture to suppose that "confusion in the use of mathematical terms" would not have been imputed to me, with reference to formula (1) Prob. xi., page 62, in my book, if the writer had understood that *dm* expressed a *superficial* and not a *material* element; but, representing as it does, a superficial magnitude, it *must* enter into the formula, notwithstanding its singular novelty! As, however, he has been dealing with his own assumption, I beg

* I have used the translation of the Abbé Bossut's Report made by Mr. Creuze, and printed in PAPERS ON NAVAL ARCHITECTURE.

simply to point out in what respect he was in error, and to add that his criticism is admissible only along with his mistake.

The exception which is taken to the following formula

$$v^2 = \frac{2\,\mathrm{P}\,\mathrm{Cot}\,\mathrm{A}}{m\mathrm{A}''\mathrm{T}kr^4\left\{\left(1+\frac{\tan^2\mathrm{A}}{2}\right)\mathrm{cosec.}\,\mathrm{A}-\frac{\tan^3\mathrm{A}}{3}\log.\cot\left(\frac{\mathrm{A}}{2}\right)\right\}},$$

is not more happy than the preceding. It appears that this was not very clearly understood by the reviewer, who having looked at the dimensions of its various members, says it leads to "the following practical results; that the angle of the screw remaining constant, the speed of the vessel is *increased* by *diminishing* the length and diameter of the screw. As far as this expression goes, what is to prevent the diameter or length of the screw vanishing when we shall have this remarkable result?—that the vessel will move faster without a screw than with it." Of this inference I have a just right to complain, as the reviewer has violated the first principle of criticism. Now m depends upon two things—the screw and the vessel; it is clearly impossible that it should vanish in the vessel; and in as far as it depended on the screw, the necessity of a limit was so evident that it was not deemed requisite to mention it. Recourse must be had to experiment to determine this; but no one who is conversant with experiments in this branch of the arts would fall into the reviewer's profound mistake of comparing a screw with blades suited to its intended use with the *shaft of a screw* separate from its blades. Would any intelligent engineer think for a moment of comparing the quantity expressed by m, and determined by experiment for a given screw, with the quantity of the like nature belonging to another screw, whose conditions were beyond all reason dissimilar?

In applying the formula to the same ship with two or more screws used at different times, it was of course supposed that those screws would be suited to such a use; for I could not imagine that "practical engineers" would attempt to diminish the length and diameter of screws beyond the limits which experience justifies; up to the limits sanctioned by physical conditions the corollaries which I deduced from this formula are strictly applicable; beyond those limits they were not intended to apply.

It is not, I presume, necessary to accompany the reviewer through the remarks which apply to the deductions drawn from this equation with reference to the quantity expressed by the symbol m, and to the supposed preferable admission into the reasoning of the law of the resistances of fluids, any further than to say that the application of this law must in this case be made under the condition which, according to the Abbé Bossut, would make the resulting error *very large*.

The difficulty which the reviewer evidently felt in attempting to deduce results from the formula

$$v=\frac{ah}{b}\times\frac{p-s}{2\,\pi h-\beta\,(p-s)}$$

$$\text{and } \omega=\frac{ah}{b}\times\frac{2\,\pi}{2\,\pi h-\beta\,(p-s)}$$

may be supposed to have resulted, not from inability to appreciate the relations of the quantities, but rather from his not having been acquainted with a certain fact in physical science, which was properly taken into account in my investigations, but which it was not necessary to state in detail, as it could not enter into the conditions of propelling ships with the screw. When I stated (p. 11), that "if the screw blade have an infinite angular velocity, the pressure of the water upon it can produce no effect to drive the vessel on," I considered the fact that the water could not, with that velocity of the screw, flow in between its blades fast enough to exert any pressure upon them; a fact which might be inferred from theory, but which experience likewise has shown.

After reading the objection made to my remarks on friction, I referred to Professor Moseley's book to ascertain whether I had mistaken his statement of the conclusion to which M. Morin's experiments led; and then, on reconsidering the subject, it seemed clear to me that as the phrase *moment of friction* must by all fair and legitimate con-

struction include the idea of *resistance*, which with propriety might have been expressed by my equation, thus, "f=the moment of the resistance of friction," the reviewer has captiously objected to a phraseology which unadvisedly included the term *coefficient*, and has, in so doing, committed himself to an error of a fundamental character in mechanics. For if the resistance resulting from friction did not increase in a given time, with an increase in the quantity of surface that comes under friction, how would uniformity of motion be determined in railway carriages and other things? It is evident that, by doubling the speed of the carriage, the distance passed over in a given time would be doubled, bringing double the quantity of surface under friction; therefore the resistance due to friction, although, at all velocities, the same for the same surface, "must be multiplied by the velocity" to obtain its true value. But if the moment of the resistance of friction did not increase with the velocity, then other things continuing the same, acceleration would go on without limit. Certainly, I shall not give up my own opinion, to embrace that of the Reviewer.

In considering the vertical oscillations produced in the sterns of vessels by Smith's three-bladed screw, it is perfectly true that I inadvertently fell into the error of attributing a resultant to its action—I say *inadvertently*, because the error could not result from the exercise of judgment—it is too obvious for that, as the judgment immediately perceives it to be an error. It is not, however, a singular thing to have fallen into an error of this kind, and even on this very subject; for Professor Main, of the Royal Naval College, in his recent work on the MARINE STEAM-ENGINE, has reasoned on the screw-propeller upon the supposition of its having only one blade instead of two; and has drawn his conclusions of the relative pressures upon the bows of the ship and upon the screw, without taking a second blade into account! Doubtless it was not an error of judgment, but an inadvertency, as mine was; to suppose otherwise would be as great a mistake. Mr. Main's error does not extenuate mine, no more do I; but the very high mathematical honours which he took at Cambridge, ought surely to be as good a pledge for accuracy as any pretension that I have ever made.

It appears by the Reviewer's statement, that it is owing to "great good luck" I have exhibited a single equation correctly. It is impossible, after this, that I can say how much I am indebted to his forbearance; for I am not stripped of *all* the pleasurable feelings which naturally arose in my mind at the thought of having done something, however small, to advance the interests of science, and to aid practical engineers whose labours in this branch of their profession had been met by difficulties at every point, prior to the developments of theory. And I cannot but remark, that it is an unjust insinuation, and one utterly unworthy of a candid Reviewer to make, that I had expressed a "sneer at practical men." If any may feel sufficient interest to inquire to whom a sneer is the easiest thing, let him dispassionately read the book in question and its review.

The writer of that article has been pleased to tell his readers that I am favourably known as the writer of some papers in the "Transactions of the Manchester Literary and Philosophical Society."

I cannot conceive for what purpose he should inform them of that fact, unless it were to aggravate the severity of his criticism. If a feeling of indifference to the advancement of science had prevailed with me to abstain from publishing any thing more, I might have been contented to enjoy without molestation the reputation of having laboured with some measure of credit in so distinguished a body. But alas! I am irretrievably committed to the consequence of publication,—a review of no ordinary character. I have carefully looked at those points which the Reviewer has deemed worthy of his notice, and have read his remarks with some attention; and having weighed the whole with as much impartiality as my personal interest would admit of, and considered the numerous imperfections of my book, and the misapprehensions and very grave errors of the review, I can only say that I have not been provoked to envy.

I am, Sir, your obedient servant,

ROBERT RAWSON.

Portsmouth Dockyard, March 4, 1851.

Having given to the world our opinion of Mr.

Rawson's Work on the "Screw Propeller," we now publish in the same quarters where that review has circulated the answer given by that gentleman. We also subjoin a few concluding remarks from the author of the Review, in explanation of his strictures, and in justification of them.

Mr. Rawson complains, at the beginning of his reply, that we have commented on his work with *severity* and *partiality*. With regard to the first imputation, we can only iterate what our review embodies—that we would gladly have shown *less* severity, and would have done so, had not the cause of truth been concerned. We felt obliged to review the work at some length, and in somewhat a severe tone, although at the risk of dragging it from obscurity, lest those into whose hands it had fallen should be led into the delusion of considering the book one of our standard works on naval engineering. And as regards the latter charge, we little thought Mr. Rawson would have accused us of *partiality*: would that we could have shown more! In these notes we must be as brief as possible, to leave room for other matter.

Mr. Rawson accuses us of falling into a grievous error in confounding the direct force of the steam in the cylinder with the moment of force exerted to turn the screw round. We have proved in the review that there is a necessary relation between the force of the steam in the cylinder and this moment; and to the review we must again refer him and our readers. We take this early opportunity of drawing attention to this pregnant fact, that whenever Mr. Rawson assails us, his choice weapon of attack is *assertion*, and not *argument*. He doubtless has excellent reasons for adopting this mode of conducting the war; but let him remember we have attacked his stronghold with the more powerful artillery of argument, and have made, we flatter ourselves, a most formidable breach: it is in vain for him to hope to turn aside our arms, and put off the day of surrender at discretion by the feeble sallies which alone he has attempted.

We cannot consent to sacrifice our mathematical deduction from mechanical principles, to the simple, though stout, denial of their truth by Mr. Rawson.

The "Surface of Vanishing Pressure" our author evidently considers his strongest point, and addresses himself with some show of vigour to its defence—with what success let us now inquire. He tells us that our remarks agree with his own. We congratulate him on this early attempt to approximate to our views; but, unfortunately, we cannot "reciprocate," as Brother Jonathan says. The agreement, however, does not last long, for immediately after he adds—"He (*i. e.*, the Reviewer) has supposed a case which we both agree to be an impossible one, and then has stated what would be the result if it were a fact."

What is this case which we *both* agree to be impossible? Does Mr. Rawson adduce his surface of vanishing pressure as a solution of the anomaly presented by the Plumper, or not? If he does not, where is the value of his surface? If he does, observe the consequences. The number of revolutions made by the Plumper's screw was 115, while that requisite for its working on the surface of vanishing pressure was 135. According to our author's account, then, not only was no pressure exerted by the water on the screw to propel the vessel, but positively, a pressure in the opposite direction to retard it; and this for a considerable period—the engine and screw working *uniformly* all the time! The screw must therefore have been working on a surface which, in accommodation to our author's nomenclature, we will take the liberty of calling a surface of *negative* pressure. What force under these circumstances was exerted to keep the vessel moving in opposition to the considerable pressure against her bows? In the case we presented to our readers, we admitted that a sudden yielding of the water, similar to the skidding of a locomotive on rails, might, for an inappreciably short space of time, relieve the screw of the pressure of the fluid; but that such a circumstance could produce no effect on the *mean* velocity of either the screw or the vessel. Mr. Rawson (in the case of the Plumper) will have to account for the anomaly of *negative* slip by a surface of *negative* pressure. Is there any resemblance whatever between our case and his? If the vessel is to be propelled at all, the pressure *must* act in opposition to the resistance of the water, and no theory which proposes to explain it by supposing either a *vanishing* or *negative* pressure, will ever carry conviction to our mind. Mr. Rawson undertakes to put our readers in possession of his views on this condition of the action of the screw. But instead of *views*, he gives us three *equations*, which he *charitably* supposes we did not understand. These formulæ really were not difficult to understand —the difficulty consisted in applying them to the case in point. Mr. Rawson accuses us, somewhat unjustly, of cautiously avoiding any notice of them. We took the only notice they deserved, by showing that they result from no physical conditions, but an imaginary hypothesis of the author. In the absence of any argument to connect them with any physical conditions, we cannot waste time in reconsidering them; and, in taking our final leave of them, we agree with

Mr. Rawson, "that it is evident that all the states of water which he describes may obtain in practice;" but it is perhaps "*little less clear* that the screw could *not* reach the surface of vanishing pressure in each (or any) of these states."

The anomalies the author speaks of we never dreamt of denying, nor is there a syllable in our review that warrants his "charitable supposition." We only denied, and still deny, that his explanation is a true one; nor can we agree with him that this denial would be too absurd for supposition after due thought had been bestowed on the subject: on the contrary, we assert that, after such thought, the acceptance of his theory would justly be so characterized.

The difficulties existed before Mr. Rawson discovered his "Surface of Vanishing Pressure," and will still exist, because his solution of them is no solution at all. The facts are undoubted. The solution is still required. We would recommend Mr. Rawson to start on a fresh scent; and if he catch the game, we will be among the first to congratulate him. In the meantime, let him bag this wholesome truth—that he has aimed his best, and missed the mark.

As this is a subject of especial interest to practical men, we will here recapitulate those points which require elucidation by our author, before a surface of vanishing pressure can be accepted as a physical fact, and which we brought before our readers in the review.

(1). *How* the vessel can be *brought* into such a position that, while the force exerted by the screw is nothing (or nearly so), the resistance against her bows is very great.

(2). If working for any length of time on or near the surface of vanishing pressure, or even, as in the case of the Plumper, on a surface of *negative* pressure, what force acts in opposition to the resistance of the water against the vessel's bows?

(3). On the supposition of an alternation of *accelerations* and *retardations* (by-the-bye, was any such phenomenon observed in the case of the Plumper?) what is to prevent the vessel moving *uniformly* when it comes to the intermediate position, where the pressure exerted to propel the vessel is equal to the resistance of the water against her bows to retard her?

(4). The engine being relieved of its load, and having nothing but friction to overcome, what is to prevent its "flying off" with an *enormous* rapidity?

Immediately following our remarks in the review on the surface of vanishing pressure, are a few lines on the author's confusions between linear and angular velocities, accelerating and moving forces, &c., &c. Upon these Mr. Rawson makes *no* comment. Probably, having had recourse to some good elementary work on mechanics, he cannot now justify this use, or rather abuse, of mechanical terms.

We now come to Mr. Rawson's remarks on the main error of his work, which he very briefly disposes of. But notwithstanding this evident anxiety to escape, we cannot permit him to gallop over the ground at so rattling a pace, but must beg him to pull up a little, that we may come to an understanding, not only as to his former errors, but the new elements of confusion which he manages to introduce even in this rapid career. He complains of our reasonings on accelerating force as by no means clear. We have endeavoured to keep clearly before the mind of our readers the fact, that linear accelerating force, represents a certain number of feet, and that angular accelerating force a certain ratio, and are not aware of having stated anything that can militate against these useful LONG-ESTABLISHED definitions. The author should have pointed out in what the want of *clearness* consisted. We cannot, however, afford time or space to be laying down first principles, which may be found in *any good elementary book on mechanics*.

Our remarks on the quantity n, however, seem to have caused much embarrassment to our author.

And here he totally misunderstands our suggestions. The quantity m did not engage much of our attention, but as he introduces it to us in a new light, we shall presently recur to it. Our suggestion was with respect to the quantity n. The best course we thought to take, would be to assume $nf(v)$ a *pressure*, *not* an accelerating force; but failing that, the *only* remaining course to arrive at true results, would have been to divide it by K^2 in *comparing* it with

$$\frac{P}{2A'TK^2};$$

and we cannot imagine how Mr. Rawson misunderstood us. To divide n or m by K^2 in the expression for the *accelerating force* to produce motion in the ship, were an error as gross as any Mr. Rawson has committed, and would not be justified were we dealing with *abstract* pressures instead of *fluid*, as Mr. Rawson seems to think. And what, in the name of common sense, is the distinction between *abstract* and *fluid* pressure? Can any one tell us?

Can pressure ever be represented otherwise than by a certain number of pounds' weight, whether it arises from the gravitation or mutual pressure of solid bodies, or the pressure of fluids against solids? The

author should have defined his *new* term—*abstract* pressure—and shown how it is distinguished from the notion of *fluid* pressure. We might then have had an inkling of his meaning; but in the state of utter darkness in which he has left us, we must still adhere to the definitions which have stood their ground so many years.

It is, indeed, *curious* and *interesting* (not only *somewhat*, but *altogether*) that Mr. Rawson should suppose, from anything we have written, that we had not made ourselves acquainted with the experiments undertaken by D'Alembert, Condorcet, and Bossut. We were as much taken aback by his wonderful powers of observation and keen perception as if he had accused us of not having made ourselves acquainted with any recent experiments on animal magnetism, so little connection has HIS OWN statement of their experiments, with the case in question. According *to his own* showing, they merely exhibited the fact, that for small oblique incidences, *the pressures did not vary as the square of the velocity*; but they never deemed, according to our view of their meaning, that fluid pressure did not exert the same mechanical effect *pound per pound*, or that it was not to be treated in the same manner as other forces. We would ask our unfortunate author, as he *has* studied D'Alembert's investigations, why he did not apply himself to a more truthful exposition of that principle in mechanics called *par excellence*—D'Alembert's principle, instead of doing as he has done—*i. e.*, instead of referring to two pages of Whewell's Dynamics, in one of which that theorem is exhibited, and the other has no connection with it—the one referring to ANGULAR effective accelerating force, and the other to *linear* accelerating force; the confusion thence arising being manifestly similar to that of one of the heroes of our most celebrated modern novelists, who, wishing to find the meaning of the words China oranges, looked for the word China and the word oranges, and combined his information. We presume, too, that it was in consequence of this report, and perhaps also from being puzzled to integrate an equation in which the square of the velocity would appear, that our author in his investigation (page 50, line 22) of the strength of the screw, boldly takes the resistance of water to be *as the velocity*—a law for the assumption of which no experiments we ever heard of have given any ground. We take this opportunity of warning engineers against results obtained on such a hypothesis—a pure figment of the author's brain.

The "*significant error*" into which Mr. Rawson undoubtedly fell, and in which he still persists, was not, as he states, the "taking a certain number of units from another certain number of units," but the taking a certain number of units of one *kind* from a certain number of units of another *kind*. He is evidently quite puzzled when we speak of *dimensions*, and deals with them as we read wild animals of the desert deal with man, when they see him for the first time. He cautiously approaches and sniffs about them, and, being unable to make out what they mean, starts off from them at a hand-gallop. We cannot otherwise account for his difficulty in understanding why

$$\frac{P}{2A'TK^2}$$

should be a quantity of *o* dimensions. He pretends to think it *funny*. To explain our meaning to Mr. Rawson more clearly, and open out a new field for his fertile genius, we will set him the following problem, which contains errors in some respects similar to his own:—*Divide* 56 *lbs. of lead by* 36 *yards of calico, and subtract from the result* 37 *gallons of spring water*. After he has done, or rather failed in doing, this problem, he will agree with us that it is most essential to attend to dimensions in physical problems, and he will, we would hope, become more grateful to us than he is at present for his wholesome correction.

The author has not escaped his usual fatality in attempting to account for his confused use of mathematical terms in Problem xi., page 62. We do not deny that the element $d\,m$ must enter into the formulæ; but it then no longer represents an accelerating force, but the product of an accelerating force and an area: and the sum of these must be divided by an area to reduce it again to an accelerating force. No mathematician, we suppose, could question this; however, to reduce it to the level of Mr. Rawson's mechanical acquirements, we will put a simple case. A plane moves in a medium, the resistance of which on every point of the surface is such, that it would move it, if free, through 10 feet from rest in the first second; the accelerating force, therefore, on *each* particle would be 20 feet. The area has a superficial extent of 30 square feet. According to Mr. Rawson, the whole plane should move in the first second through 300 feet, that being the product of the area, and number representing the one-half of the accelerating force. According to us, it would move through 10 feet, because we should divide the product of the area and the accelerating force on each particle by the area, to obtain the effective accelerating force on the whole plane. Let Mr. Rawson ponder over this example, and in the mean-

time let mathematicians judge between us, and saddle the mistake on the right back.

And now we come again to the author's unfortunate expression—

$$v^2 = \frac{2P \text{ Cot A}}{mA'' \text{ T}hr^4 \left\{ \left(1 + \frac{\text{Tan}^2 \text{ A}}{2} \right) \text{Cosec A} - \frac{\text{Tan}^4 \text{A}}{3} \log \left(\cot \frac{\text{A}}{2} \right) \right\}}$$

which, with the partiality authors are known to show to their own productions, he thinks has given us as much trouble in deciphering as doubtless it has cost himself in giving it birth. He says we have violated the first principle of criticism. What is that first principle? Is it that we have followed his investigation into some of its legitimate consequences? Certainly, had we entertained the slightest suspicion of the meaning he attached to the quantity *m*, we should not have let him off so easily as we did. He appeals to practical men to judge between him and us in this matter. Now what will practical men say when they are told that *m* is constant which enters into the expression for the resistance of the fluid against the bows of the vessel, and that Mr. Rawson actually treats it, and modestly supposes that we treat it, as depending upon the *screw* as well as the vessel!!! When practical engineers wish to take into account this resistance against the bows, do they take the screw into account as an element at all? We do not defend their practice altogether, because they assume that in all cases the midship section is the plane of resistance—*i.e.*, the plane on which, moving through the water with the same velocity as the ship, the resistance of the water would be the same; but if Mr. Rawson will take the trouble to inquire, he will find their practice to be this—that in comparing the *performance* of one vessel with that of another, they estimate this resistance against the bows by the product of the area of the midship section, and of the square of the velocity of the vessel. Did any one before our author dream of such a manifest absurdity as that of introducing the screw as an element to be considered? The fact is, our author is determined to set the world right upon the doctrine of resistances. He sets about this certainly in a novel way;—first by misdirecting the experiments of D'Alembert, &c., to an end which would have filled their minds with horror, viz., *unsettling the well-established definitions of mechanics;* and then, by assuming that every law which their labours went to disprove, viz., that resistances vary as the square of the velocities (which our author always assumes except when he cannot integrate his expressions on this assumption, as in page 50). He is evidently thoroughly mystified; his brain is pregnant with a vague and misty explanation of resistances; but, alas! when it comes to the birth, it proves an abortion, or rather a monster violating all the laws of nature.

As usual, he accuses *us* of falling into the profound mistake of comparing a screw with blades suited to its intended use, with the shaft of a screw separate from its blades. We did no such thing; but we purposely followed his *ignis fatuus* to some distance, till it enabled us to point out to him and the world the quagmire into which it would have led us. We always thought that, in physical science, equations which represent physical facts, would show their own *necessary* limitations; the author, it seems, is of a contrary opinion. He modestly takes credit to himself for *enlightening* practical men through difficulties which previously beset them at every point; but, at the same time, very wisely begs them to trust to his theories, only so far as *their own* previous experience bears him out! "What on earth is this wonderful benefit, then, that he has conferred on practical men?—Beware of the quagmires!"

Our remarks were perfectly legitimate on his formula, presented as it was as a result of a profound physical investigation. But to please our author, and to enable practical men to judge between us we will, interpret his result in a way that he cannot well find fault with. The author will not, perhaps, think that a difference of two feet in the diameter of a screw is much out of the way. Let us take, then, his favourite, "the Plumper," which has already proved to *him* an *ignis fatuus*. We see that the diameter of the screw-blade is 8 feet 9 inches; let us suppose it *reduced* to 7 feet. What shall be the practical result according to our author's formula? Simply this—that her speed should be *raised* from 7·42 to 11·87 knots an hour nearly! Will any practical engineer believe this? Or will her constructor be inclined to propose its adoption?

In our remarks on the other formulæ which the author has noticed, he accuses us of displaying ignorance of a certain fact in physical science. This is an *assumption* of his made in his usual *bold* style, for we cannot see what right he has to draw this conclusion from what we have said. Our business with these formulæ was confined to the sole consideration of reconciling them with the author's own statements. And surely we have a right to expect that an author

should not contradict himself so grossly as we have shown Mr. Rawson to have done. If he refers to the review he will see that we expressed no opinion whatever on his reasoning on page 11 of his work. We never did doubt, that the fact he there states is correct—indeed it is so self-evident that we would not suppose *even he* would question our knowledge of it, as the screw then becomes a cylinder. What the author has not done, and which our remarks invited him to do, is this—to reconcile the deduction from his formulæ; viz., that the velocities of the ship and screw become infinite *together*, with the "*certain* fact in physical science," viz., that if the velocity of the screw were infinite, that of the ship could be *nothing* being propelled by no force. The author's remarks in this, as in other cases, are therefore simply beside the question.

Now with regard to friction—the author treats our remarks as though we had objected to the use of the word *coefficient*. We assure him, we were quite willing to accept f as expressing the friction itself. We called his attention to the term *coefficient*, because it appeared to us that he had not sufficiently made himself acquainted with the fact that the friction always bears a certain definite ratio to the *pressure;* which *ratio* is called coefficient of friction—the author treating it as a coefficient of *velocity*. We have also turned to Mr. Moseley's work and cannot find anything in it to countenance his very unhappy use, or rather abuse of the laws M. Morin has established. Those laws are very plainly stated by Mr. Moseley, and we cannot conceive how any one in the full possession of his faculties could mistake them. We recommended to Mr. Rawson's particular attention the 3rd law, p. 139, "that when no unguent is interposed, the amount of the friction is, in every case, independent of the *extent* of the surfaces of contact, so that the force with which two surfaces are pressed together being the same, and not exceeding a certain limit (per square inch) their friction is the same whatever may be the extent of their surfaces of contact." How is this *law* reconcileable with our author's statement. "For, if the *resistance* resulting from friction did not *increase* in a given time with an *increase* in the *quantity* of surface that came under friction, how would uniformity of motion be determined in railway carriages and other things?"

The real fact is, the author has conceived that we have committed ourselves to an error of a fundamental kind in mechanics, simply by his own inability to appreciate a distinction which we pointed out in our review between resistance or force of friction at *a given instant*, and the amount of work developed by it *in a given time*. His remarks with regard to the amount of resistance developed in the form of *work* to retard a steam engine are true, and *are just what we pointed out in our review*. But the author's expression for the accelerating force to produce angular motion of the screw is $\frac{P-fw}{2A'TK^2}$ if true would obtain only for an instant, and does not pretend to express the work developed during any length of time. To make the question at issue between us intelligible to practical men, we will state the case thus: Suppose a locomotive drawing a weight of 100 tons (the friction being 8 lbs. per ton,) to be propelled with such a power that it travels at the rate of 20 miles an hour. Now, suppose the power increased so as to drive it at the rate of 30 miles an hour. What is the friction in the second case? *We* assert the friction to be still 8 lbs. per ton. Mr. Rawson would make it, according to his mode of applying Morin's law, 12 lbs. per ton. According to us, the amount of work developed by friction in the two cases, multiplying the amount of friction by the space passed over by its surface of application would be represented by the numbers $800 \times 20 \times N$ and $800 \times 30 \times N$ (where N is the number of feet in a mile) or in the proportion of 2 : 3, or of the velocities; whereas Mr. Rawson would represent them by the numbers $800 \times 20 \times N$ and $1200 \times 30 \times N$, or in the proportion of 4 : 9, or as the squares of the velocities ! ! !

The author omits all notice of a large part of our review extending from the 153rd to the 156th page of our present Volume; which is precisely that which would present the fairest mark to him as a mathematician if wrong. This the author evidently cannot deal with, and so very wisely passes it by *sub silentio;* and we must, therefore, infer that he cannot defend his own views which we there attack—otherwise (at all events) than by assertion.

We must now briefly notice his investigations on the oscillation of the stern of a vessel. He retracts his resultant of the three equal blades; but justifies his error on the score of inadvertency. Now it is not the inadvertency of the error of Mr. Rawson respecting the three-bladed screw that we at all objected to. Every one is liable to mistakes, especially those who write as Mr. Rawson does, while their time is fully occupied with other public duties. But it was the very want of judgment he displayed, in not weighing his results in his mind before he published them to the world,

and so gravely advised practical men to adopt his suggestions. Had it not been for our noticing this error, every time we felt peculiar oscillations on board a screw-steamer, we should have been told one of the blades required to be lengthened. The author justifies his want of judgment by a similar error, he tells us he has discovered in Professor Main's work. It is not our province to defend Professor Main; we can only observe, that had Professor Main committed fifty such mistakes, this would have afforded no valid defence of the author at the bar of the public, who do expect the exercise of some degree of caution and judgment in those who ask them to adopt the results of their speculations.

We might have expected that the author's wonderful penetration would have enabled him to have discovered that we denied the very existence of a radial force in the remarks we made on this subject. We certainly expected some attack on this ground. Now, however, though unattacked, we will tell Mr. Rawson that he is utterly wrong in describing it as "characteristic," as "a distinguishing feature" of Mr. Smith's screw that it can produce no oscillations on the stern of a vessel. This property belongs to Woodcroft's screw, and all screws which comply with these simple conditions—that their surface is described by a straight line moving parallel to a fixed plane, and passing through a straight line perpendicular to that plane, and the arc of *any directing curve whatever*. Practical men who seek improvements in the form of existing screw-blades need be under no apprehension such as Mr. Rawson's observations are calculated to inspire—that they cannot vary the form of the surface without introducing oscillations destructive to the vessel, if they take care to conform to the simple condition stated above.

That we may not lay ourselves open to the accusation of making bold assertions which we cannot defend by argument, like our author, we will attempt a proof of this proposition in as simple and intelligible a form as possible.

The plane which touches a surface at any point in it, contains all the lines which at the same point touch all the possible sections that can be made of the surface passing through the same point. The generating line is such a section, and since it is a straight line, must therefore lie *wholly* in the tangent plane. The resistance of the fluid at any point acts in a direction perpendicular to the surface or tangent plane at that point, and therefore perpendicular to the generating line or *radius of the cylinder*. Hence the resolved part of the pressure of the fluid in the direction of the radius is zero. But this is the only part of the pressure that could tend to produce oscillations on the stern. Hence there can be no such oscillations.

The equation which Mr. Rawson, "by great good luck," exhibited correctly, he seems from the nature of his remarks to consider a discovery. We thought we had made it sufficiently apparent to him that it was the well-known principle of virtual velocities which he thus, by a compensation of errors, reproduces; and so even here he may pluck from his brow the sole remaining laurel leaf that we left him. He tells us he is "irretrievably committed to the consequence of publication." This is nearly the only sentence in his answer to which we can give our full assent; and we fear that until he has unlearnt all he now thinks he knows, and lays in a stock of sound, unconfused, clear, first mechanical principles, he will still remain "irretrievably committed." His authorship of certain memoirs in the "Transactions of the Manchester Literary and Philosophical Society" was mentioned by us only to justify us in the eyes of the world for noticing a book full of such grave errors and misapprehensions, which would, indeed, mislead no mathematician, but might entail on pratical men, to whom it was particularly addressed, endless expense and difficulties, and as we have seen in the case of oscillations, might check them in their attempts to seek improvement in the form of the screw-blade itself.

Having inserted Mr. Rawson's answer to our criticism, we cannot afford space in our Magazine for further controversy on this subject.

Errata.—The following errors of the press occurred in the Review referred to in the preceding papers; but it will be seen that none of them in the least affect the points in dispute between the Reviewer and Author.—ED.

Page 151, col. 2, line 18, for

$$\frac{P}{2A' \, TK}$$

read

$$\frac{P}{2A' \, TK^2}.$$

Page 152, col. 1, line 36, *et seq.*, for $mA'' vx$, read $mA'' v^2$.

Page 152, line 38, *et seq.*, for $f(V-V)$, read $f(V-v)$.

Page 153, col. 1, line 11, for $f=0$, read $s=0$.

Ibid. In the note, line 34, for *or*, read *as*.

Page 153, line 41, for "formed in," read "founded on."

Page 154, col. 2, line 31, for

$P' \times 2\pi n\nu$, read $P' \times 2\pi n r$.

Page 155, col. 1, line 20, for

$$P=\frac{PR}{2\pi},$$

read

$$P=\frac{pR}{2\pi}.$$

Ibid. Col. 2, alter the entire notation here, *et seq.*, to the following:—

$$R_{\omega}=\frac{\pi Y_{\omega}}{pI}.$$

Page 156, col. 1, line 5, for

$$G(\sqrt{3}-1)^2,$$

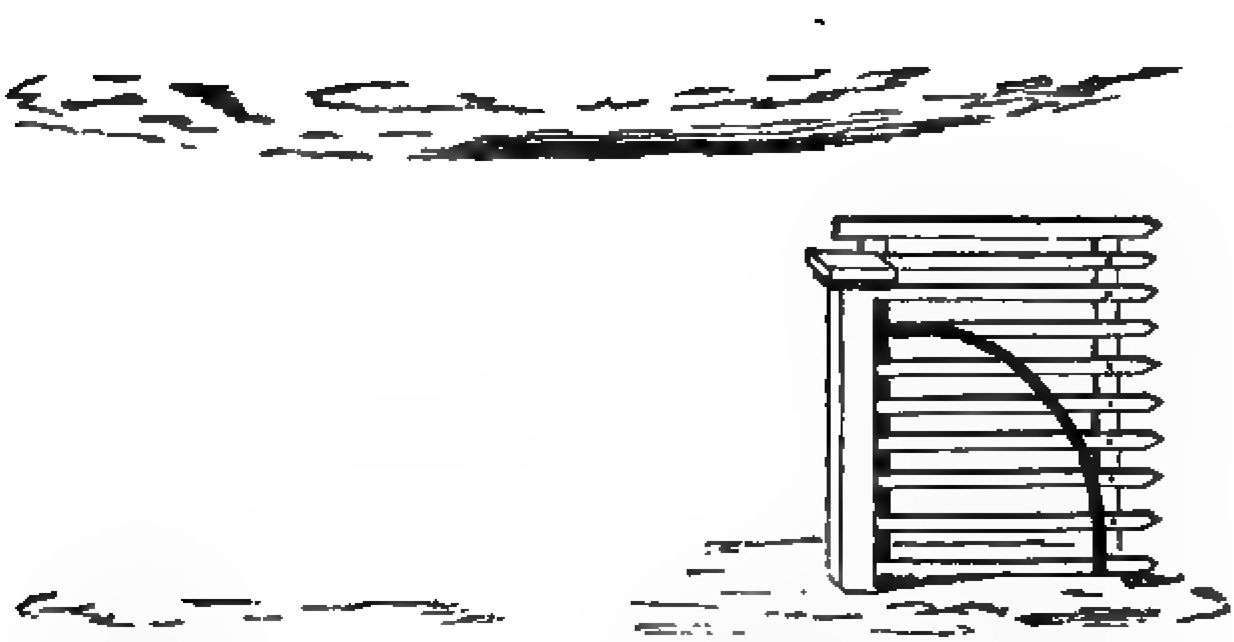
read

$$G(\sqrt{3}-1).$$

AMERICAN SWING GATE.

(From the American *Farmer and Mechanic*.)

Fig. 1.



This improvement in hanging and operating gates was secured by letters patent to Thomas Parkinson of Ontario, Co. N. Y., August 6, 1850, and has already gone into extensive use in the western and middle part of this State, being generally adopted for farm purposes. They are so simple in their construction that any common farmer can make them with very little expense, as nothing but boards and nails are used—no mortices or tenons, nor iron in hanging; but simply turning edgewise through an open post upon a single wooden pin as represented in fig. 1.

Besides their cheapness, these gates possess many advantages. In their operation they are exceedingly convenient, as a team can be driven close to them from either side, on any grade. They save much trouble in opening—are safer, being entirely out of the way of the team in passing—can never be left ajar by careless shutting, and swing open after

leaving them, or be opened by the wind when thought securely fastened. They are less liable to get out of repair, as they, by their weight, either when open or closed, do not strain themselves, or drag over the posts. They are less liable to be obstructed by snow or frost than any gate in use.

DUCATION OF MECHANICS' DAUGHTERS.

Since a mechanic's girls are as dear to him as his boys, the education of the daughters cannot but be of equal importance with that of his sons—nay, in many instances, still more so, seeing the embarrassment the industrial classes labour under in finding suitable virtuous employment for young females; little apology, then, seems requisite in calling attention to the improvement of a girl's education. In one respect, that of girls is said, in No. 1431 of this Magazine, to be superior to that of boys; namely, the giving to the former instruction in one industrial occupation, that of the needle —an art essential to their own economical tidiness whilst single—to that of their husbands and children, if married—a requisite in all domestic servants, especially those of the higher descriptions—and affording at all times the means of earning a livelihood, scanty though in too many instances it be. But the importance of needlework being thus acknowledged, that of other arts equally conducive to the well-being of the industrious classes, it must be allowed, are almost universally neglected in schools for girls. Washing, ironing, house-cleaning, cookery, the care of infants—a girl is left to pick up how she can; from good methods and examples or from bad. With the exception of needlework, it would seem the object of most schools to bring up a host of *literary ladies*, rather than good and economical wives for industrious artizans. Happily, however, the errors of such teaching are now beginning to be perceived and acted on; her Majesty, the Queen, has set a good example in her school at Windsor; at the National-school at Finchley, instruction in laundry-work and cookery is afforded; and other instances might be adduced, where the kinds of domestic industry suitable for females, are taught with more or less detail.

Religious and moral training is no less important to girls than to boys; but this provided for, what next should enter into the education of a girl of the industrial classes? She should be enabled to earn an honest livelihood by her own industry so long as she remains single; afterwards, as a good wife and mother, she should know how best to make the husband's earnings go far in procuring comforts, no less than necessary to make his home a happy one, and to rear their progeny in health, in industry, in morals, and religion. What are the acquirements requisite to enable her to fulfil these duties?

The married woman of the industrial class should, besides competency in needlework, know how best to clean and keep a dwelling in order—to give zest to the frugal meal by the goodness of its cookery and neatness of its serving—to administer to the wants of infancy, and to the healthful, moral, and religious progress of the child thereafter—to tend the sick—and to give comfort in withering old age. If such be the duties of the wife, they are no less so of the domestic servant; not only where a single one is kept, but also occasionally of every individual of a numerous household. There is nothing new in this enumeration; but it is as essential in education, as in other matters, to specify what is wanted in order to provide for its attainment.

As to house-cleaning—an end of board, a gimlet, and chisel, may be easily introduced for practice in a school of boys; not so a house to be cleaned in one for girls. The want of subject matter to exercise girls upon in household work, has doubtless been an obstacle to the affording instruction in sweeping, scouring, dusting, and so forth; though in many schools the means of practice they themselves afford are neglected. Thus in many national schools charwomen are hired to clean even the school-room; in other better instances, the pupils do this business, together with the school-mistress's apartment: but even in this case the quantity of matter to be worked upon is not sufficient; additional subjects for practice in household work should therefore be sought according to local circumstances. For example, under proper superintendence, the daily sweeping and dusting of the church, with its weekly more thorough cleansing,

would afford practice in general housework; besides that, the care of cushions, draperies, books, and the burnishing of brass-work might be acquired, and even that frequent attention to windows, without which glass in a town is never bright. The boys' school and its appurtenances might also be brought under the care of the household-work mistress of a girls' school; and further, it would be advantageous to the pupils were the cleaning of some public buildings entrusted to them under that mistress. Another useful art in household matters, as in apparel, is that of avoiding to dirty or to injure walls, furniture, or clothing; many possess the art of making clean compared to the few who habitually avoid dirtying or injuring surrounding objects. The "penny saved is the penny got" in the rich man's house no less than in the poor one; the careless servant, by destruction of matters under her charge, deprives the master of so many means of according her gratuities; the money which might otherwise have been bestowed on her must go to replace what she has injured; and as a wife, it is essential to be careful in the use of household goods and clothing. This lesson in domestic economy is so rarely inculcated in schools that it is longer dwelt on here than the subject might seem to merit, yet it is only by bringing forward such particulars that attention to them can be hoped for. An error should also be noticed which some schools have fallen into where the premises are cleaned by the girls; it is, that they are *paid* for it—so far from payment being admissible, household work should be considered as much a part of female industrial education as any other branch of it.

The Finchley school furnishes an example of the way in which laundry-work may be taught. The girls bring from home soiled linen to be washed, dried, and ironed by themselves. This being an eleemosynary establishment, it furnishes soap, fuel, and other necessary articles gratis: in an independent school it were better that each girl should bring the soap, starch, &c., required for her washing, taking home again the several remains—thus the girl would know the quantity of these articles she had consumed in her operations; the mother would judge whether economy of them had been observed at the school—nay, perhaps receive a wholesome lesson herself in the avoidance of waste. Often and often is soap left to dissolve uselessly in the wash-tub or house-pail. These are petty matters to descant upon; apparently; not so if it be taken into account how much the sufficiency of a man's earnings to support a family depend upon the thrifty habits of his wife.

A lesson in account-keeping is furnished in the laundry department of the Finchley school; each girl takes home with the clean linen a written account of the value of the washing she has done: this washing bill is, however, erroneous in one respect, namely, that the cost of soap, fuel, &c., is not noticed, —so that the whole amount of the bill stands as the value of the girl's labour. Though the school may make a present of the necessary materials, the cost of them should be noticed in the bill, and its amount be deducted from the price charged for washing and getting up the linen—the remainder only being the value of the child's labour.

In speaking of accounts, it may be observed that the sums set for children to work should bear relation to their own outgoings and incomings. It should not be deemed beneath the dignity of scholastic education to set sums consisting wholly of pence and farthings for the lower orders of children, and for very young ones—to give an interest in arithmetic by setting down expenditures for fruits or sweets instead of bales of wool, and so induce a taste for useful expenditure by showing how accumulated savings of even farthings would, in a short time, buy desirable articles of clothing. The keeping accounts of the poorest man's expenditure often leads to carefulness; a poor labourer on his ten shillings a week being asked how it was he obtained so many comforts for himself and family, attributed his humble affluence to his setting down every farthing he expended,—"He should feel shame to see a single one set down for tobacco or gin." It is more from examples in humble life than from general declamation, that the moral effects of different heads of education can be obtained.

Cookery, as above mentioned, is also taught at Finchley, and a manual on the subject (No. 1) has been drawn up with care, first for the use of school-girls, and

subsequently published,—so that it is likely to be extensively useful. The girls are at Finchley afforded practice in the art by cooking a dinner once a week for themselves. Might there not have been taken from their own laundry arrangements a more useful mode of teaching the culinary art? Might not the girls, once a week, bring the family dinner to be cooked, as they do its linen to be washed? It would be difficult in a school to provide the bits and scraps with which thrifty housewives often make up a dinner—the cold meat to be warmed, the bones to form the basis of a soup, the cheap *cuttings** to make a savoury pie or stew. At first, some little reluctance might be felt to sending scraps—exhibiting how little the mother of a numerous family has to bestow on food. So far from shame, the prudence of the mother should be lauded, and the daughter taught to appreciate such a conformity of expenditure to means. Another essential article in domestic education might be thus acquired; namely, the care and cleanliness of saucepans, glass, and crockery. The destruction of such articles in houses of the industrial classes is often enormous; there are frequently twice or thrice as many tin saucepans worn out for want of care in an English kitchen as there are of the brittle earthenware pots used for the same purposes on the Continent.

The teaching girls to cook homely fare would prepare them well for operations on a more liberal scale, since the principles on which a few *cuttings* may be well prepared are the same as those on which the joint may be properly dressed, or even the most elaborate specimens of the culinary art; it is those principles, therefore, that should be most assiduously inculcated—they are, in fact, a branch of chemical science. Baron Liebig, and other distinguished chemists, have not disdained of late to investigate the particulars on which the preservation of the flavour of meats depend, as well as their tenderness in boiling, roasting, or otherwise preparing; and the maxims and practice of good cooks accords with the precepts of the chemist. It could not be amiss, since it is thus that girls should be instructed in the reasons why they are taught to do so and so in cookery, as also in laundry work. It would interest children, and be of permanent use to them, because we all are most steadfast in a beneficial practice, when we know the grounds on which it is founded. Why should not girls be taught the effects of the radiation of heat, for example? Sir Humphrey Davy, in his early lectures at the Royal Institution, vouched for the superiority of tea made in a burnished silver teapot over that made in an earthen one, saying at the same time he knew not why. He made afterwards the discovery, and it influences in cookery and laundry work:—heat is more rapidly conducted by dull surfaces than by reflecting ones; hence the contents of a bright-bottomed stewpan are longer in heating than if in a similar vessel blackened with smoke: the new, bright smoothing iron does not heat so soon as the old dull one. Further, both in cookery and washing, the testing roughly the different qualities of water is of much importance—the effects of its hardness on different substances, and the means of softening it when hard. In a sanitary point of view, also, the chemical properties of some waters should be made known to children, since many springs contain matters which rapidly dissolve various metals, as zinc, copper, lead, and that in sufficient quantity to render water standing in such vessels a poison. Information of this nature, because truly scientific, might be deemed unsuitable in the industrial education of a girl; but whether would this be more useful to her in after life, or a knowledge as imparted in national schools of many fabulous or doubtful points of even English history?

That important branch of female education, the care of infants, was a good deal considered by Sir Samuel Bentham; and no reasonable objection seems to militate against his plan. It was, that at a school *babies* should be taken as day nurslings—the infants of that very numerous class who are from home all day charing, at laundry-work, sewing for upholsterers, &c. He projected the sending round a caravan to collect the babes of a district, and conveying them, dry and warm, to the school; a payment being made by the mother commensurate with the expense of a day's food for her child, and also a change of necessary clothing; the mothers being allowed admission to suckle their infants, at least at the usual

* "Cuttings" are the pieces cut off from the best joints of meat, to give them a handsome shape. These cuttings are usually sold at about half the price per pound that is charged for the joint itself.

time of dinner. His inquiries led him to conclude that a single experienced head nurse, with the assistance of pupils in this branch of education, might tend a hundred or more babies, and that in a manner far superior to the care usually bestowed at home on the infants of such mothers—praiseworthy mothers—since, to earn by labour wherewithal to support themselves and children, they sacrifice the pleasures attendant on maternal attentions. Infants of such persons are, in the existing state of things, left usually to the care of some elder child, exposing her to all the temptations that solitariness may subject her,—wearied, if not permanently stunted,—deformed by carrying about a child too heavy for her years, and altogether ignorant of the signs which betoken illness in her charge.

Girls in a school would, it may be urged, have no more strength than if at home. Granted; but in such a nursing establishment, mechanical means would be introduced for giving infants exercise without throwing too great a weight on the pupil nurses. When Jeremy Bentham, about sixty years ago, was writing for a periodical publication of Arthur Young's, several papers on pauper management, he consulted an eminent physician as to many items in the case of children; and various machines were then devised for giving them exercise. Whether they appeared or not in that publication is not known; but there is now a "baby-jumper" on sale. An improved *go-cart* might be introduced—a padded enclosure, where infants might roll and creep without danger, besides many other contrivances to save young girls from the mischievous effects of lugging about heavy infants.

In many parts of France, *crèches*, as they are called, have of late been established for the reception of babies during daytime, and with beneficial results; but these *crèches* differ from the proposed plan, inasmuch as they nowise contribute to the education of girls, either as to maternal duties or to those of the nursemaid.

Good physical care in infancy is in itself of great importance to the well-being of the future adult, but still more so the management of the *mind*. A baby, when looking steadfastly at an object, is studying it, and should not be disturbed in its investigations; yet how continually is it seen to be turned away at the whim of its nurse; it cries from disappointment—some rattle is shaken to amuse it, or sweets put into its little mouth, and thus it learns that crying will procure a pleasure; hence unsteadiness of application is early produced, the temper ruffled, and the lesson taught that benefits may be obtained by violence. Under an able superintendent, the pupils of an industrial school would be enjoined to avoid these and other errors of the same nature which so frequently lay in early infancy the foundation of ill-temper and numberless other evils.

The care of infants in sickness being taught in such a school, does not imply that it should become an infirmary; so far from it, all contagious disorders should be rigidly excluded for the sake of both babes and nurse-pupils enjoying health; but the infant frame is subject to many disorders that are harmless to others, and, indeed, frequently soon cured if duly attended to at first. It is not only infants of the poor that often suffer from improper diet, sometimes too heavy for their tender powers of digestion, more frequently from a commencement of acidity in the food; and even where its kind is suitable, the babe is often gorged with it, and indigestion, with its attendant maladies, ensue. The nursing pupils would be instructed how to avoid such sources of disease, and where it might arise from mismanagement under the parental roof, would learn how to remedy the mischief by suitable treatment during the day.

Administration to the wants of the old and infirm in many respects resembles the kind of care required in the nursery of infants, so that the nursery-school would teach the principles on which old age should be attended to: the same patient forbearance is required in instances of querelous old age as in that of the wayward child—the same endeavour to diminish sufferings in serious illness of the child and the adult, and by amusement to distract attention from lesser ailments. Happily, as to the care of the sick and infirm, the "good Samaritan" is often seen in the very lowest orders of the people. Often do the poorest women give up their time, and the best part of their scanty meals, to succour an invalid. It is, therefore, principally to teach the most beneficial mode of administering such aid, that instruction under this head is needed.

To conclude: it is said, in No. 1431 of this Magazine, in regard to boys'-schools, that "*gratuitous* education is not contemplated, since eleemosynary aid of any description destroys the praiseworthy sentiment of independence and reliance on a man's own exertions." The same observation is equally applicable to the gratuitous education of girls. It has been shown in that publication that, for sixpence a week, a boy could be well taught some useful art in addition to the subordinate arts of reading and writing. It seems necessary to add only, in regard to a girls'-school, that, since the services of women may always be obtained at a lower rate of pay than those of men, the industrial education of girls could be afforded for a lesser sum than that of boys. M. S. B.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING, MARCH 19, 1851.

Robert Longdon, the younger, of Derby, glove manufacturer, and Thomas Parker Tabberer, of Derby, manufacturer of elastic fabrics. *For improvements in the manufacture of looped fabrics.* Patent dated September 12, 1850.

The patentees describe and claim,

1. An improvement in narrowing and shaping knitting fabrics, by employing a larger number of tickling points than usual, and carrying the work back, not only to the selvages or edges, but at the interior, by which there will be no necessity to divide the ends of the work, which are intended to form the fingers of gloves and other similar articles. The tickling points are disposed in two rows, those which are to work at the selvages or edges (for which purpose five points at each edge or selvage are employed) being bent down to form the lower row, and being capable of being used without necessarily bringing the other row into action. By this system of working, any part of the middle of the work may be tickled as well as the selvages, at the discretion of the operator.

2. An improvement in the construction of needles used in machinery for the manufacture of looped fabrics. This improvement consists in making the stem of the needle of greater thickness and strength than the point, and that part which receives the work. The requisite thinness of the bearded end of the needle may be obtained in several ways; such, for instance, as drawing that part through a smaller die than the other, but the patentees prefer the application of chemical agency. To this end a solution is prepared consisting of sulphate of copper dissolved in distilled water in the proportion of 1 lb. avoirdupois to the gallon. The wires destined to form the needles are inserted in a thin board with the parts to be reduced in the thickness projecting. They are then immersed in the solution, and allowed to remain in it till sufficiently thinned down, which may be ascertained by inspection. The needles are subsequently manufactured in the usual manner. In order to prevent the solution from acting on other parts of the metal than those which are required to be so treated, the board through which the wires are passed has a shallow ledge formed round it at the back, and melted fat is poured in and allowed to consolidate about the stems of the needles.

3. A method of manufacturing knitted fabrics with a fleece or projecting loops on one side. Heretofore in producing work of this description, it has been usual to employ double-knibbed sinkers, one knib being lower than the other, the lower knib producing the projecting loops or fleece by making the loops longer than the other ones. Now the present patentees employ ordinary sinkers with needles alternately having long and short beards, so that at one time the presser may press the loops off all the beards, and at another time only off the beards of every alternate needle, by which the loops on the needles having long beards may be knocked over, the needles with the shorter beards receiving and holding the work. In working, the loops for the body of the work are produced in the ordinary manner; the fleece (or projecting loops) is then produced by laying the thread in the usual manner, and drawing the jacks, and lowering the lead sinkers as usual, and then pressing the needles whilst over the arch. By bringing forward the work, it is pressed off every alternate needle; that is, off every needle having a long beard, the work being then received and held by the needles with the short beards. The working is continued in the ordinary manner till the next row of fleece is to be formed, when the method of working above described is repeated.

4. A method of making knitted fabrics with a ribbed appearance on one side, by the employment of needles with long and short beards, in combination with two-knibbed sinkers, each with two knibs of a like length. In working according to this method, the two threads may be used either of the same or of different sizes, colours, or materials. The course is worked in the usual manner of working with double-knibbed sinkers, except that the pressing is twice in each course, once over the arch, and once off the arch. In pressing over the arch, the front loops are pressed off the long-bearded needles,

and the work is caught by the short-bearded needles only; the back thread is brought under the long beards, and the frame is then thrown up, and in so doing, the back thread is moved behind the short beards, and the course worked in the usual way. The fabric thus produced has ribs or stripes (as the case may be) on one side, and a satin appearance on the other.

5. A method of making fabrics with India rubber therein. It has been usual hitherto to employ threads of India rubber, either in a set or inelastic state—the necessary elasticity being imparted to the material by the subsequent application of heat or in the elastic state; but without stretching the thread, so that the material, when made up, will not contract to such an extent as is desirable. Now to effect the necessary contraction, the patentees propose to introduce the elastic India rubber in a stretched state, so that the fabric, when made up, may contract considerably. The thread-carrier used for thus working in the strand consists of a tube, down which the India rubber thread proceeds, and is delivered at the lower end. A rod is passed through the tube with an eye through it for the passage of the India rubber thread. This rod is carried to and fro with the carrier, and so long as the eye or opening is away from the sides of the tube, the India rubber will pass through freely; but immediately the rod is drawn to one side, and the India rubber is held securely thereby, the further movements of the carrier will cause the India rubber to be stretched for a distance equal to that which the carrier passes over after the holding of the India rubber. The extent of stretch given to the India rubber may be regulated by the workman; but the best way is to attach a cord to each end of the rod, the cord being slack so long as the India rubber is to be delivered freely, and becoming tightened when the India rubber is to be held, so that although the rod is allowed to move with the carrier, it is nevertheless held tight during its further movements.

6. A method of making the "socks" or uppers of boots. According to this part of the invention, the sock is made of knitted material, with an elastic band at top; the application of which, however, is not here claimed. The lining is formed of brown Holland or other suitable non-elastic fabric; with the exception of a portion over the ankles, where there is inserted at each side a piece of India rubber material, such as is manufactured according to the method last described. By this means additional strength, combined with elasticity, is obtained at the sides over the ankles, where the India rubber fabric is introduced.

THOMAS LUCAS PATERSON, of Glasgow, manufacturer and calico printer. *For certain improvements in the preparation or manufacture of textile materials, and in the finishing of woven fabrics, and in the machinery or apparatus used therein.* Patent dated September 12, 1850.

Claims.—1. A mode of regulating the building or laying-on of the yarn or thread, in winding or other machines of a similar nature, by the application of a stop apparatus, in which the absence of the dragging tension of the yarn, in case of fracture or derangement, suspends the building action.

2. The employment of such stop apparatus acted on by the dragging tension of the thread.

3. The employment of friction connections between the copping motions and the winding spindles.

4. The use of an oscillating lever or arm acted on by the dragging tension of the thread.

5. A method of working the copping motion of an entire range of spindles by the use of a continuous shaft.

6. The employment of flat or conical metallic surfaces in the formation of the joints between the fixed and revolving pipes or ducts of dressing machines, and other machines of a similar nature.

7. A method of compensating for the angular tension exerted upon the fabric in the process of being stretched, by proportioning the length of the straps or pieces of the flexible belts to the length of the inclines of the angling finishing rail.

8. A method of effecting the necessary compensation by the action of the flexible belts themselves.

9. The employment of a double or divided breaking or angling action, by the adaptation of two or more straps of the flexible band to one incline of the angling finishing rail.

10. The use of angled guide grooves, or of an angling rail with double sets of pulleys, for the purpose of traversing the fabric.

11. The employment of flexible metallic belts or straps for the purpose of communicating the angling motion of the guide rails to the fabric.

WEEKLY LIST OF NEW ENGLISH PATENTS.

George Little, of New Peckham, electro-telegraphic engineer, for improvements in electro telegraph, and in various apparatus to be used in connection therewith, part of which improvements are also applicable to other similar purposes. March 14; six months.

Herbert Taylor, of Cross-street, Finsbury, Middlesex, merchant, for certain improvements in the manufacture of carbonates and oxides of barytes, and strontia, sulpur, or sulphuric acid, from the sulphates of barytes and strontia, and for consequent improvements in the manufacture of carbonates and oxides of soda and potassia. March 15; six months.

Richard Archibald Brooman, of the firm of J. C.

Robertson and Co., of Fleet-street, London, patent agents, for an improved method of manufacturing screws. March 15; six months.

Herbert Minton, of Hart's-hill, Stafford, gentleman, and Augustus John Hoffstaedt, of Bridge-street, Blackfriars, London, gentleman, for improvements in the manufacture of faces or dials for clocks, watches, barometers, gas-meters, and mariners' compasses, or other articles requiring such faces or dials. (Partly a communication.) March 17; six months.

Alexander Robertson, of Holloway, Middlesex, engineer, and James Glover, of the same place; roller, for improvements in the rolling and laminating of metals, and in the manufacture of metallic cases and coverings. March 20; six months.

James Hart, of Seymour-place, Middlesex, for improvements in the manufacture of bricks, tiles, and other articles made from plastic materials, and in the means of making parts of the machinery used therein. March 17; six months.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, Middlesex, engineer, for improvements in the manufacture and refining of sugar, and in machinery or apparatus used in producing a vacuum in such manufacture, and which last improvements are also otherwise applicable for exhausting and forcing fluids. March 20; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Mar. 12	2726	John Blair, Esq., jun.	Camphill, Irving, Ayr	Military tourists, and emigrants portable couch or bedstead.
,,	2727	Edmund Vesey	Bath	Box hoop, or cap for carriage spring.
,,	2728	Frederick Ayckbourn and Leopold Cobian	Strand	Folding boat.
13	2729	George Holcroft	Manchester	Steam boiler.
14	2730	Charles Marsden	Waterloo-house, Kingsland	Syphon funnel.
,,	2731	Perkins and Sharpus	Bell-court, Cannon-street	Enlarged heating surface bottom for coppers, pots and kettles.
15	2732	H. S. Rogers	Basinghall-street	Child's velocipede carriage.
18	2733	James Phillips	Lambeth	Greenhouse gas stove.
,,	2734	Thomas Fillary	Coldbath-fields	Land-labour machine.
,,	2735	Henry Earnshaw	Wimpole-street	Dumb jockey.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

March 6	87	W. R. Bangust	Hackney	The patulus A'Tergo shirt.
,,	88	I. Anderson	Elgin, N. B	Car.
7	89	B. Black	South Moulton-street	Carriage lamp.
8	90	A. and E. Stone	Brompton and Margate	Self-acting and regulating effluvia preventive trap.
,,	91	E. Chamault	South-street, Finsbury	Stick-smoking pipe.
10	92	H. Hicks	Davies-street	Otium saddle.
,,	93	Robertson, Carr & Steel	Sheffield	Radiating and reflecting register stove grate.
,,	94	H. W. Keele	Isle of Wight	Calendar or date indicator. The hemorascope.
11	95	J. L. Stevens	Copthall-buildings	Omnibus ventilator.
12	96	W. F. Ross	Bishopsgate-street Within	Peruke spring.
,,	97	J. Abery and T. Denman	North-street, Hackney	Water closet.
,,	98	R. Dax	Welchpool, Montgomeryshire	Nose band horse stopper..
,,	99	R. Dax	Welchpool	Nose band horse stopper.
,,	100	M. Frearson	Paddington	Ventilating shield cowl.
13	101	Augustus Adams	Lime-street	Sanitary drain trap.
,,	102	Mary Ness	Huddersfield	Window-cleaner.
,,	103	Walter Smith	Maidstone	Early calling machine.
,,	104	James Farquharson	Great Ealing	Spring stump for a wooden leg.
,,	105	W. S. Adams	Haymarket	Tap.
14	106	Hugh Greaves	Manchester	Coupling for rails, and for connecting rails to sleepers.
,,	107	Benj. Clarke, M.R.C.S.	Chelsea	Anti-apoplectic or self-adjusting shirt.
,,	108	Henry Laxton	Pall-mall East	Parlour cooking stove.
15	109	W. and S. Dingley	Sherborne	Protector (coat).
18	110	William Stahl	Great Pulteney-street	Divider and callipers.
19	111	A. R. Peel	Strand	Hippolytic tug (harness).

CONTENTS OF THIS NUMBER.

Description of Wilson's Sewing Machine.—(*with engravings*) ... 221
On the Review of Rawson's Treatise on the Screw-propeller. By Mr. Rawson ... 223
Note of Reviewer ... 226
American Swing Gate.—(*with engravings*) ... 233
Education of Mechanics' Daughters ... 234
Specifications of English Patents Enrolled during the Week:—
Longdon and Taberer..Looped Fabrics ... 238
Paterson ... Textile Materials .. 239
Weekly List of New English Patents ... 239
Weekly List of Designs for Articles of Utility Registered ... 240
Weekly List of Provisional Registrations ... 240

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M. LELONG BURNET'S PATENT WATER-PURIFYING PROCESSES.

Fig. 1.

4.

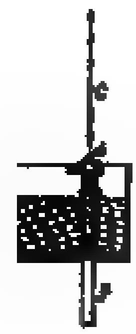

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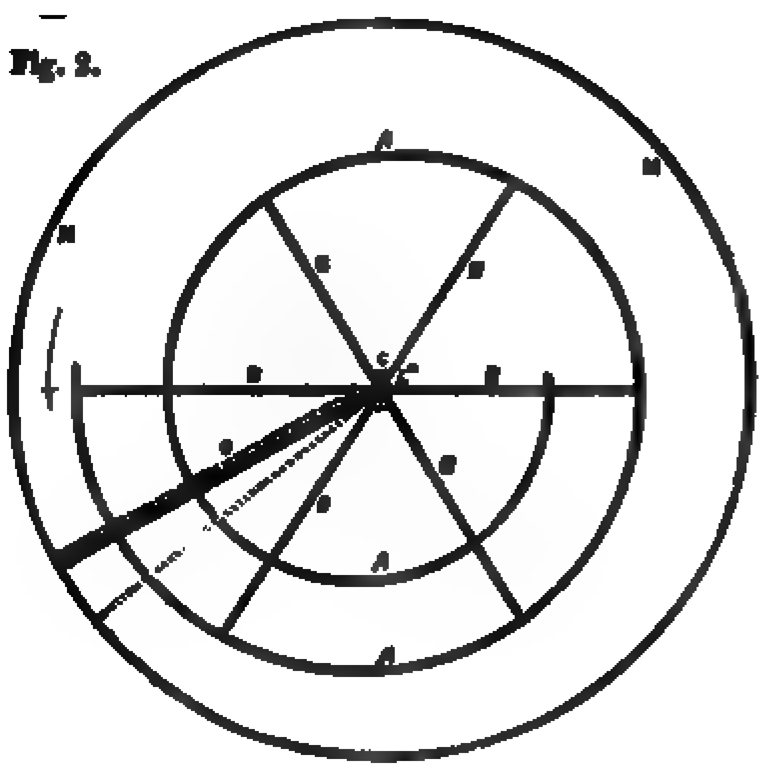
Fig. 2.



M. LELONG BURNET'S PATENT WATER-PURIFYING PROCESSES.

(Patent dated September 19, 1850. Patentee R. A. Brooman (on behalf of M. Lelong Burnet). Specification enrolled March 19, 1851.)

Specification.

WHEREAS according to the methods heretofore in use for preventing incrustation in steam-boilers, and other vessels used for the boiling or evaporation of water, the practice has been to introduce the re-agents used for the purpose into the steam-generator, which has been attended with the disadvantage of increasing the impurity of the water. And whereas also, the re-agents hitherto used for the prevention of such incrustations have, as used, been found insufficient, or at least uncertain and partial in their application. Now the nature of the said invention consists, *Firstly.* In freeing the water from all matters capable of being precipitated by boiling before the introduction of the same into the boiler or other steam-generating vessel. *Secondly.* In the employment of chemical re-agents exactly suited in each case to the quality of the water required to be purified. And, *Thirdly.* In the application of the said preliminary process, and the said chemical re-agents, to the purification of water generally, whe.her intended for subsequent boiling or any other purpose whatever.

The preliminary purification of the water is effected by treating it on a large scale in cisterns, tanks, or other suitable reservoirs, altogether separate and distinct from the vessels to which the water is to be transferred for actual use or delivery. These reservoirs are fitted interiorly with an agitator or agitators, by which the water is kept in a state of agitation while the chemical re-agents are being added. The working of the agitators is then stopped, and the foreign matters are allowed to precipitate. In about four hours the precipitation will have taken place, and the clear and purified water may be drawn off for use.

Fig. 1 exhibits a sectional elevation of a purifying apparatus on the above plan; and fig. 2 a horizontal plan thereof on the line 1, 2. M is the reservoir which is made of a conoidal form with convex bottom, and set in brickwork; *i* a cover, which is made to fit closely to the top of the reservoir; C a hollow vertical shaft which turns at top in a collar H, formed in the cover *i*, passes down through the centre of the reservoir, and revolves at bottom in a socket G, which is supported by a cross-piece G^2; AA is a spiral rail which is connected to the shaft C by radial stay-pieces or arms BB, and forms with these arms the agitator before referred to; a^4 is a cock, through which the water to be purified is supplied to the reservoir; f^2 a funnel fixed in the cover *i*, through which the chemical re-agents are dropped into a perforated tray f^3, from which they fall in showers into the water; b^2 a cock by which the water is drawn off after being purified, and which is placed at a point just above the presumed level of the precipitated matters, and of any foul water which may become mixed with them; *o* a brush of a form corresponding with that of the bottom of the reservoir, by which the bottom is swept occasionally (a scraper may be substituted for a brush); h^2 is a rod by which the brush *o* is actuated independently of the agitator, and which is passed down from the top through the hollow shaft C and socket G; and d^2 is a cock at the bottom of the reservoir, by which the sediment and slush are from time to time drawn off. The machinery, by which the agitator and brush are respectively put in motion when required, is as follows:—To the top of the vertical shaft C, and immediately above the cover *i*, there is attached a bevel pinion J, which gears into a bevel wheel K, on the end of a longitudinal shaft C^2, which is supported by standards NN raised from the top of the reservoir. The shaft C^2 carries at its outer end a bevel pinion P, which gears into a bevel wheel R on the top of a vertical shaft S, which turns in bearings *q* and T, thrown out from the side of the reservoir, and terminates at bottom in a bevel pinion U; which last pinion, U, takes into a bevel wheel V, on the end of a short horizontal shaft C^3, supported by a standard *x*, to the opposite end of which short shaft is attached a crank-handle *y*, by the turning of which the whole of this system of wheel-gearing is put in motion, and the agitator-shaft C caused to revolve. If the agitator is to be worked by steam or other than hand power (as it may be), such power may be applied through the medium of a driving pulley, as Z^2, affixed to the shaft C^3, and

the parts P, R, S, T, U, V, C^3, *x*, and *y*, be dispensed with. The rotation of the brush (or scraper) is effected by means of a separate handle attached to the top of the rod h^2, which is prolonged upwards beyond the top of the hollow shaft C, and is supported in that prolongation by a bearing h^3 raised from the top of the cover *i*. The handle may be either reached by ladder, and turned by hand, or worked from below by cord and pulley. When it is desired to raise the brush (or scraper) from contact with the bottom of the reservoir, which it is generally desirable to do for a short time at the commencement of each course of purification, the rod is lifted in its bearing h^3 till a notch in it comes opposite to a spring bolt *l*, fixed on the top of the bearing h^3, when the bolt takes into the notch, and lays fast hold of the rod. When it is afterwards desired to allow the brush to descend, the spring bolt is drawn back by means of a cord or chain attached to the back of the bolt.

An apparatus, such as described, has been found to answer well in practice, and is such as the inventor would recommend in all cases where the apparatus has to be constructed anew; but it may be proper at the same time to observe, that the efficacy of the apparatus for its intended uses, does not depend essentially on any particular form of the reservoir, or on any particular disposition of the agitator or brush; or, indeed, on any of the details being exactly as before described. All that is requisite to the full accomplishment of this part of the invention is that the water should be kept in a state of mechanical agitation while in the course of purification, and that arrangements be made for drawing off the upper or clear portions of the water from above the sedimentary and fouler portions at bottom. Both these objects may be effected with other forms of reservoirs as well as the conoidal; and, in fact, there is no form of reservoir now in use to which this plan of mechanical agitation may not be adapted, with a few slight additions and alterations, such as I shall now proceed to exemplify.

[Ten exemplifications here follow; from which we select two of the most prominent.]

Fig. 4 represents a water-tank or reservoir of a rectangular form, which is supposed to obtain its supply of water from a pipe *e*, inserted into the bottom of the vessel, and to have a delivery pipe at *f*, communicating with a steam boiler, or hanging loose, as at railway-stations, for occasional connection with the tender or boiler of a locomotive engine. In this case the delivery-pipe is prolonged upwards to near the top of the inside of the tank by means of a piece of hose, either of cloth, leather, caoutchouc, or any other suitable material, which terminates at top in a buoyant mouthpiece or float *a* of any convenient form. The hose is kept distended by means of internal metallic rings in a manner well known, but which admit at the same time of the hose being pressed to one side or other of the tank without any inconvenience. To the mouth-piece *a* there is attached a chain or cord *c*, which is carried upwards over a pulley placed in any convenient situation, by means of which chain or cord the mouth-piece can be raised above the level of the water while the process of purification is going on, in order to prevent any of the unpurified water, or any of the materials employed in its purification, from entering the delivery-hose. A cover being fitted to this tank, and an agitator introduced (as in the apparatus first before described), and a waste-pipe, *u*, added for the occasional withdrawal of the sediment and slush, no further alteration or addition would be necessary for the complete adaptation to it of this purifying system. As soon as each tankfull has undergone purification, the floating mouth-piece would of course have to be lowered to the top level of the water; and the specific weight of the mouth-piece must be so calculated that when quite free from the tension of the chain *c*, it shall just dip below the surface of the water in which it floats. All the water then drawn off from the tank would come from the clear and purified portion at the top.

Fig. 9 exhibits a modification, in which the water is drawn off by means of a syphon.

In all the arrangements of apparatus before described one tank or reservoir only is supposed to be used; and this is what we commonly find to be the case, more especially at railway stations: but in many instances, and in all where frequent deliveries of water are required, great advantage would result from the employment of separate tanks for the purification and the delivery of the water.

The re-agents employed vary necessarily with the quality of the water which is to be purified, and the nature of the foreign ingredients intermixed with it. Those which the inventor has found most generally applicable, are the following:

Barytes, or its soluble salts.
Strontia, or its soluble salts.
Oxalic acid, or a soluble oxalate.
Tartaric acid, or a soluble tartrate.
Sulphuric acid, or a soluble sulphate.
Phosphoric acid, or a soluble phosphate.
Pyrophosphoric acid, or a soluble pyrophosphate.
Boracic acid, or a soluble borate.
Any soluble salt of lead.
Vegetable ashes.
Soap.
Caustic or carbonated potash.
Caustic or carbonated soda.
Caustic or carbonated ammonia.
Lime, either quick lime or slacked lime.
Any organic acid, which yields insoluble salts of lime.

To ascertain which of these ingredients, or what combination of them, is the fittest to be applied in such case, a small quantity of the water to be purified is subjected to a preliminary analysis by any of the well-known methods in use. Thus, for example: If the water is tainted with sulphuric acid, and it is wished to ascertain what quantity of chloride of barium (which is known to be a good re-agent in such a case) will suffice for its removal, a graduated test-tube is to be filled with the water; a solution, composed of a known weight of chloride of barium and distilled water, is then to be added, drop by drop, to the water in the tube (which causes a precipitation of the sulphuric acid in the form of sulphate of barium), until no more precipitate is formed; and by comparing the two quantities—that is, the quantity of the water tested with that of the test liquor used—a measure of the quantity of solution of chloride of barium which will be requisite on any scale, however large, is at once obtained. A similar method of proceeding is to be followed with the respective re-agents for any other constituent which is required to be removed.

To illustrate the principle of this method of purification more in detail, I will give a few examples, worked out at length:—

First Example.

Suppose the water to be purified, is to be afterwards converted into steam for the use of locomotives, or for any other purpose, and that it has been found on analysis to contain, in every imperial gallon, the following foreign matters:

Bicarbonate of lime...............	10·503	grains.
Bicarbonate of magnesia..........	5·602	,,
Chloride of sodium...............	1·387	,,
Chloride of calcium	1·400	,,
Chloride of aluminum............	0·700	,,
Chloride of iron	0·700	,,
Silica	0·700	,,
In an imperial gallon.....	20·992	grains.

The elements of these foreign matters may be classed under three heads,—the gaseous, the insoluble, and the soluble: the first, including the carbonic acid in a state of combination; the second, the carbonates of lime and magnesia, and the silica; and the third, the chlorides of sodium, calcium, aluminum, and iron.

Of the carbonic acid there would be dissipated in the process of evaporation 3·2097 grains, resulting from the decomposition by heat of the calcareous bicarbonate in neutral carbonate of lime, and 1·9542 grains additional, resulting from the decomposition of the bicarbonate of magnesia,—making together 5·1639 grains of foreign matters; but instead of leaving the carbonic acid to be thus evolved and dissipated by the action of heat, certain re-agents are added to the water beforehand, by which the decomposition of the bicarbonate is effected. For example; a quantity of lime

is added sufficient to unite in excess with the carbonic acid likely to be evolved by the process of evaporation, from which there results a neutral carbonate of lime, which is deposited at the same time along with the neutral, calcareous, and magnesian carbonates (which last had been previously held in solution by the carbonic acid transferred to the carbonate of lime). The only fixed matters, therefore, not disposed of by precipitation are,—

the chloride of sodium	1·387	grains.
" calcium	1·400	"
" aluminum	0·700	"
" iron	0·700	"
" silica	0·700	"
	4·887	grains.

In the water which has here been given as an example, the iron exists as a chloride; but as carbonate of lime possesses the property of decomposing chloride of iron, forming peroxide of iron and chloride of calcium, there is a slight addition of the latter salt due to the decomposition. This amount may be calculated from a knowledge of equivalents; and from this calculation, it follows that in the decomposition of 0·7 grains of chloride of iron, 0·717 of chloride of calcium is formed. This being in addition to the chlorides of calcium, and aluminum, and silica existing in the water, there remains in all only 4·904 grains of foreign matters instead of the 20 992 grains originally existing.

Or, what would be still better, more lime may be added than is necessary to combine with the carbonic acid, when the chloride of aluminum existing in the water is decomposed into alumina, which will be precipitated along with the carbonates of lime, magnesia, and iron, while the chlorine set free will unite with the calcium of the lime which has been employed to effect these changes. It is true that, according to the laws of chemical equivalents, 0·7 of chloride of aluminum, when thus decomposed, will give 0 871 grains of chloride of calcium; therefore it should seem that the excess of lime employed in this process must be detrimental: but on a large scale, so slight a degree of impurity may safely be disregarded. And if it should be required to carry the precipitation to its utmost possible limits, this may be done by adding enough of oxalic acid to precipitate the lime from the chloride of calcium; though, considering the cost of that acid, there can be few cases in which it would be worth while to have recourse to it.

Sal-ammoniac might be added to the water in sufficient quantity to make the carbonic acid pass into the state of carbonate of ammonia, which would produce a precipitate of the carbonates of lime and magnesia, dissolved by the aid of this carbonic acid; and the carbonate of ammonia so formed would, in its turn, act on the chloride of calcium, and produce a new portion of calcareous carbonate, which would be precipitated, while the ammoniacal salt would remain in the water. But the result, in this case, would have no superiority over that obtained by the process first described.

Second Example.

Suppose the water to be purified has been found by analysis to differ from that treated of in the preceding example, in containing some calcareous sulphate or sulphate of lime, instead of calcareous and magnesian carbonates, then, to purify such water, select from the list of re-agents before enumerated that which will, at the least cost, act most effectually on the sulphate—say, for example, chloride of barium. For every one hundred parts of sulphate of lime in the water, add about one hundred and fifty-two parts of chloride of barium, which transforms the one hundred parts of sulphate of lime into eighty-one and a half parts of a very soluble salt—the chloride of calcium. Should the water contain also some sulphate of potash, as is not unfrequently the case, a greater quantity of chloride of barium must be used; when of every one hundred parts of sulphate of potash, fifteen will be precipitated in the form of sulphate of baryta, and eighty-five remain in solution in the form of chloride of potassium.

It may here be observed that, though the aggregate amount of soluble substances

contained in the water may remain the same after it has been subjected to these chemical operations as before, yet nevertheless there will always be a great advantage gained whenever, by such operations, new salts are formed more soluble than those which existed in the water in its natural state. The chlorides, for example, in the case last treated of, are more soluble than the sulphates; and, above all, the chloride of calcium, which is so soluble as to be deliquescent.

Should there be any sulphate of soda in the water (beside the sulphates of lime and potash, or either of them), it may be got rid of by transforming it by means of barytic chloride into chloride of sodium, which is nearly as soluble when hot as cold.

Third Example.

Suppose the water to be purified, is found on analysis to contain both sulphates and carbonates of lime, then a combination of the re-agents used in the first and second examples are to be employed for their precipitation. But if the sulphates are in very small quantities, they may be disregarded altogether as being, on a large scale, of no practical consequence.

Fourth Example.

Water is sometimes found acidulated to such an extent, as to act injuriously on the metal of boilers and pipes. Alkaline substances should be used for the counteraction of this evil; preference being given to lime before all others, on account of its abundance and cheapness. If the acid is hydrochloric, the addition of the lime gives rise to a very soluble chloride. If the acid be sulphuric, carbonate of ammonia is a better re-agent than lime, because the lime would produce a difficultly soluble sulphate, whereas the sal-ammoniac gives rise to a sulphate of ammonia which is readily soluble.

Fifth Example.

Water is frequently charged with organic substances—vegetable and animal—and this sometimes together with bicarbonates or sulphates, or both. In such cases, there should be employed, simultaneously with the means used to act on the carbonates and sulphates, chloride of lime, or some substance such as sulphurous acid or chlorine, in order to decompose such organic matters. These may either be used in the gaseous state or dissolved in water; or their salts, the sulphites or hypochlorites (as, for example, bleaching powder,) may be added to the water; then, by the addition of an acid, the sulphurous acid or chlorine may be liberated, according as it may be expedient to use the one substance or the other for this purpose. But to obtain the best results, and to prevent the addition of foreign matters to the water, it is preferable to use these gases, or either of them, in a separate state.

Some water, which the inventor has recently experimented upon, obtained from Lancashire, contained so large a quantity of organic matters, besides a small proportion of sulphates (though no bicarbonates), as to be quite black in colour, and of a very fetid smell. The purification of this water was completely effected by treating it with an aqueous solution of chlorine, in the proportion of 1·041 cubic inches of the solution, temperature 41° Fahrenheit, to 61·028 cubic inches of water, and adding simultaneously therewith chloride of barium in the proportion of 3·766 grains for every litre (1·760 pints English) of water. Care, however, must be taken in all such cases to add no more chlorine than will just give the water a slightly dissolvent property, which will be readily ascertained by its turning a test-paper, dipped into it, white. If the chlorine is in excess, it will act injuriously on the metal of the boiler and pipes: and though that excess might be counteracted by the addition of such substances as would take up the free chlorine—as sulphurous acid, sulphate of protoxide of iron, protochloride of tin, &c.—the addition of such new substances is certain to impair the purity of the water, and to lessen its fitness for use.

General Observations.

I add here some general observations, which are more or less applicable to all the cases of which examples have been given.

In recommending, by preference, the use of lime, sal-ammoniac, and chloride of

barium, I have had regard solely to the prices at which they can now commonly be had for use on a large scale, and not to any superiority which they possess, or may be supposed to possess over other re-agents specified in the list before given; for there are others in that list which, if price permitted, would answer equally well, and which may, in a different state of circumstances, be substituted with advantage.

The processes of purification which I have described may, in many cases, suffice of themselves to render water fit for its intended use; but in others it may be expedient to subject the water to subsequent filtration through charcoal and other media; as, for example, where the water is designed for domestic use, or for some manufacturing purposes where great purity is desirable,—as brewing, dyeing, &c.

MESSRS. MAIN AND BROWN'S "TREATISE ON THE MARINE STEAM ENGINE," VINDICATED FROM THE STRICTURES OF MR. RAWSON. BY PROFESSOR MAIN.

Sir, — My friend, Mr. Rawson, is equally unfortunate whether he endeavours to advance science by his own publications, or by discovering errors in those of other writers; and as he has alluded to what he is pleased to call an inadvertency in a recent work on the steam engine, published by me in conjunction with Mr. Brown, I hope you will allow me a few lines in your columns to refer to this, and likewise to the other allusions, he has made to our work in his publication on the Screw Propeller. In that publication, page 9, he says, "this formula, which expresses the area of the screw blade in terms of its length, &c., is more simple than the one given by Professor Main and Thomas Brown, Esq.;" and again, in page 10, he adds—"Taking the screw blade, whose dimensions are $r=2{\cdot}833$ feet, &c., $p=8$ ft., and $h=2{\cdot}5$ feet, which is the screw selected by Professor Main; and by using the first formula, we shall have the correct area $A'=11{\cdot}0915$ square feet for each blade; and by using formula (3), we shall have $A'=11{\cdot}1246$, a little too great. The approximation recommended by Professor Main gives $A'=11{\cdot}4615$." Lastly; in the conclusion of his article in your Magazine for March 22, No. 1441, he says "I have fallen into the same kind of error as himself." I hope to be able to show these complaints to be so groundless, that I ought to be much indebted to Mr. R. for bringing them forward with such a serious air.

To the first charge I need scarcely allude, being content with your Reviewer's decision, that though in Mr. R.'s *own* opinion, his result is the simpler, yet in reality, my method of obtaining mine, is the neater of the two.

With regard to the second, Mr. R., instead of saying "the approximation recommended by Professor Main gives $A'=11{\cdot}4615$," ought to have said—"In *addition* to investigating an *elaborate formula, to which my own is similar*, and with which it is *nearly identical*, Prof. Main gives a *practical* rule for ascertaining *roughly* the area of a screw blade by *scale* and *compass;* and that this method is sufficiently accurate will be seen by the result,—for whereas the accurate area is $11{\cdot}0915$ square feet, the approximate method gives it $11{\cdot}4615$ square feet." He might also have stated, that this method is much used by engineers, when they do not wish to aim at any very great accuracy.

With respect to the third charge, I think Mr. R. more than usually unfortunate. To shield himself from the consequences of publishing to the scientific and practical world a blunder which, if heeded, would have involved engineers in much needless expense, and all this arising from his not exercising his judgment on what, as he says, he ought to have discovered to be a mistake, he tells you, "I have been guilty of a similar error in my investigations on the same subject, because I have reasoned on the screw propeller upon the supposition of its having *one blade instead of two.*" Mr. R.'s penetration would indeed have been great if, from what I stated, he had discovered that I intended the propeller to have *neither more nor less* than two blades. I am sure I need not remind Mr. Rawson that *some* propellers have *three* blades,—for after your Review he will not be likely to forget it soon. Nor can I help thinking it strange that after luxuriating through so many pages of his work, among screws of such various forms, and astonishing the world with

such wonderful and *unexpected* results,—after showing that the anomaly in the motion of the Plumper was to be accounted for by the screw working on a surface without being pressed by it in the direction of its motion,—after speaking of and reasoning upon *accelerating force*, as estimated by *pounds avoirdupois*,—after stating, in page 24, that by *diminishing* the radius of the screw, the velocity of the vessel will be *increased*, and *vice versâ*, in page 28, viz., that a *large radius* will diminish the velocity of the vessel *very rapidly*,—after stating that the moment of the force to drive the screw round is an entirely different quantity from the force of the engine measured by the indicator, notwithstanding the indicator has always been used to measure the moment of force in screw engines, precisely as in paddle engines,—after showing practical men that the cause of the three-bladed screw shaking the after parts of a vessel, and injuriously affecting the fabric, arises from the resultant of a radial force, though in truth there is no radial force at all, and even if there were, the three forces would balance each other, and there would therefore be no resultant,—after showing how this *imaginary* resultant of an *imaginary* force might be *exorcised* by lengthening one of the three blades (yet even here the advice is bad, for, practically, it would be much easier to shorten two than to lengthen one—and if the *previous theory* is to go for anything, it *would materially conduce to speed*),—lastly, after showing some wonderful qualities in Smith's screw, in that it does not produce these injurious effects, but which, if the effects were not wholly *imaginary for every right conoid*, Ericsson, Woodcroft, Blaxland, Lowe, and all other inventors would equally claim,—after all this it does seem to me strange that he should blame me for interfering with a propeller that has *more or less* than *two* blades. Has he, by his discoveries, acquired a vested right in all propellers except two-bladed ones, that he warns me off so summarily? The real truth is, it arose from no inadvertence at all, and (to use your Reviewer's remark), he has again aimed well, but missed his mark. The investigation and the results would have been precisely the same if there had been several blades, because the object of the investigation was to discover *a law*, and not to obtain *numerical* results. To show Mr. Rawson he is not over keen in these matters, I will tell him of one *inadvertency* in this very investigation, which probably escaped his notice, for the scent lay rather cold.* I call it *inadvertency* because it does not affect the final results, otherwise I must have called it by some harsher name. I refer to the quantity I have taken to measure the slip of the screw; and, as Mr. R. would say, "I consider it unhappily selected, because it does not fall in with the conventions as used and known by practical men;" and I promise him it shall be altered in the forthcoming new edition of the work, although I cannot humour him by yielding to his wishes respecting the number of blades of the propeller. I do not know that I should have noticed this subject, or Mr. R.'s allusions either, had it not been for the opportunity it gives me, of stating that I consider the laws obtained, to have some practical value from their accordance with facts obtained by careful experiments in the *Dwarf*. It will serve also to show that care was taken, *by due exercise of judgment*, to verify the laws obtained before publishing them to the world. If Mr. R. had done this, he would have escaped your censure.

The conclusions I arrive at are these:

(A) The slip of the screw will be diminished,

1. By the increase of the area.
2. By the decrease of the angle.
3. By the increase of its diameter.

(B) 1. The horse power of an engine driving the screw (in still water) varies as the cube of the speed, as in paddle engines, *so long as the same screw is retained.*

2. And *whatever* screw be used in the same vessel, the horse power varies as the square of the speed of the ship multiplied by the speed of the screw.

The following Table will show to what extent these laws may be depended on.

I am, Sir, yours, &c.,
THOS. J. MAIN.

R. N. College, Portsmouth,
March 24, 1851.

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* By-the-bye, did it escape Mr. R.'s critical eye that there is no mention of more than one engine for this one-bladed screw?

Diameter of the Screw 5 feet 8 inches.							
		Area of Screw.	Speed of screw per hour.	Speed of ship per hour.	Slip per cent.	Indicator H. power.	(Sp. of ship) × speed of screw.
∠ 24° 12′	A	8·9	13·094	9 111	30·419	168·8	1086
multiple of	B	13·3	12·264	8·939	27·112	137·0	980
gearing	C	17 8	12·052	8 955	25·697	144·6	965
5·16 to 1.	D	22·2	11·532	8·647	25·017	131·7	862
∠ 30° 6′	A	8·9	14·225	9·049	36·387	154·0	1165
multiple of	B	13·3	12·931	8·606	33·447	148·7	958
gearing	C	17·8	12·548	8·742	30·823	136·3	959
4 to 1.	D	22 2	12·572	8·889	29·295	143·8	993
∠ 30° 6′	A	8·9	13·999	8 608	38·510	138·5	1037
multiple of	B	13·3	13·066	8·307	36·423	134·0	901
gearing	C	17·8	11·532	8·403	32·948	126·6	884
5·16 to 1.	D	22·2	11·823	8·284	29·933	127·3	811
∠ 36° 37′	A	8·9	16·426	9·064	44·758	176·9	1353
multiple of	B	13·3	14·902	8 880	40·411	161 7	1175
gearing	C	17·8	14·585	8·827	39 479	166·4	1136
3·13 to 1.	D	22·2	13·905	8·523	38·706	149·5	1011
∠ 36° 37′	A	8·9	15·568	8 380	46·172	147·5	1093
multiple of	B	13·3	13·584	7·923	41·670	118·5	853
gearing	C	17·8	13·789	8·290	39 880	151 6	948
4 to 1.	D	22·2	13·254	8·010	39·560	139·5	850
∠ 36° 37′	A	8·9	14·581	7·856	46·122	136·3	901
multiple of	B	13·3	13·390	7 644	42·913	114·2	782
gearing	C	17·8	12·778	7·518	41·165	111·5	722
5·16 to 1.	D	22·2	12·449	7·525	39·553	108 9	704
Diameter 4·5½. Pitch 10·32.							
∠ 24° 12′			15·677	7·940	49·353	144·9	988

MR. FROST'S "STAME."

Sir,—It appears to me that the discrepancy for which your correspondent, Mr. Cheverton, has taken so much pains to account (in his remarks, *ante* p. 205, on Mr. Frost's "stame"), originated solely in his having overlooked a most palpable error in the calculation which he takes as the text of his comment. He calls attention to the great difference between the ratios of 14 to 9, and 49 to 12, the first indicating a saving of 35, and the last of 75 per cent. But if he will take the trouble to look over the account of the experiments with which he starts, he will see that in comparing the pressure in the two cases, he has forgotten to include the steam pressure in the first, and he has taken only the vacuum. The actual pressure during the first experiment is *not* 12 lbs., but 21 + 12, or 33; and therefore the ratio of the pressures in the two experiments is *not* 49 to 12, but 49 to 33; which last your correspondent will find to be as nearly as possible the same as 14 to 9. I am, &c., AN IMPARTIAL OBSERVER.

DYKE'S PORTABLE COOKING APPARATUS.

(Registered under the Act for the Protection of Articles of Utility. James Dyke, of Back-road, St. Margaret's, Ipswich, Smith, Proprietor.

Fig. 3.

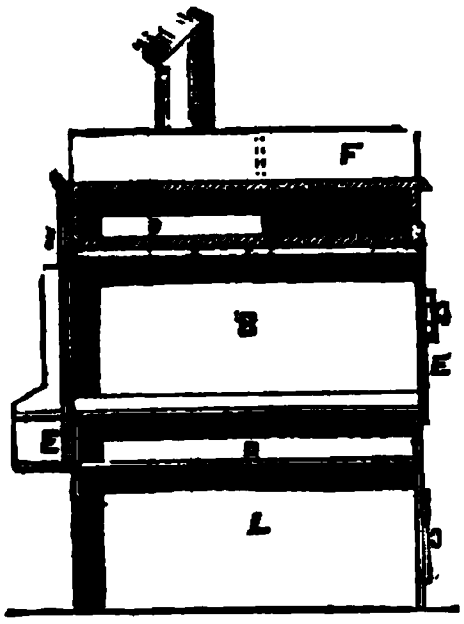

Fig. 1.

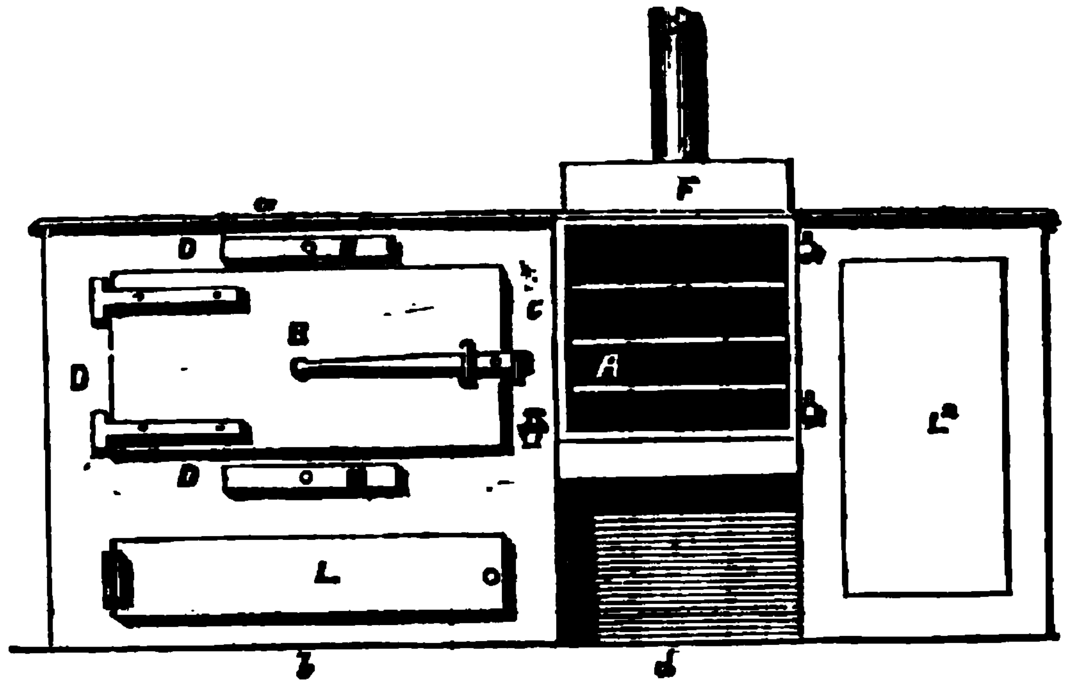

Fig. 4.

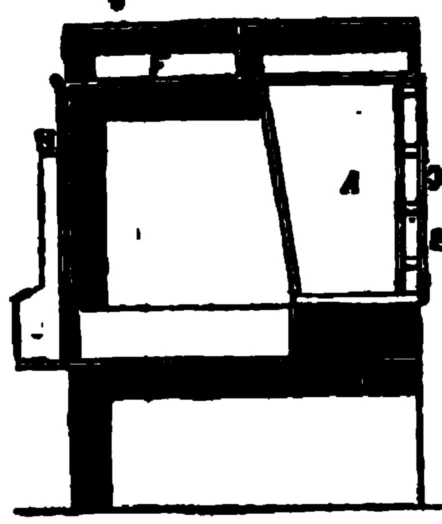

Fig. 2.

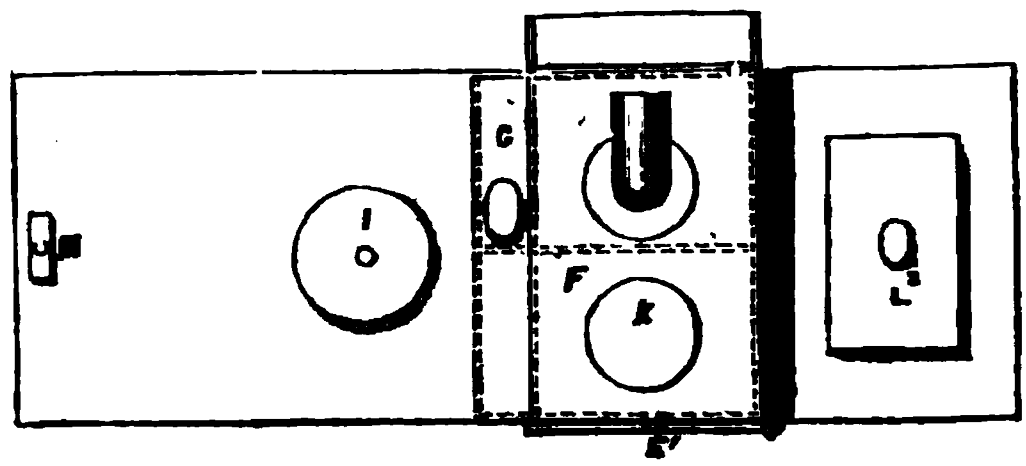

Fig. 1 is a front elevation, and fig. 2 a plan of this cooking apparatus; fig. 3 is a cross section taken on the line *ab*, and fig. 4 a cross section on the line *cd*. A is the grate or fire-place; B a brick or tile-lined oven; C a boiler, which is interposed between the fire-grate and the oven; D, D, D, are flues, by which the smoke and heated vapours are conveyed first over the top of the oven, then over the outer end to the flue underneath, from which they escape into the chimney by an opening E; E¹ is a door by which the front of the grate can be covered over; a plain plate is laid over the top of the fire, which causes the heat to pass through the flues D, D, D. F is a moveable head, by the use of which the heat of the fire may be directed either around the oven or conveyed at once into the chimney. G G are dampers or slides, by which the passages through the head are opened or closed to regulate the heat; and H a damper, which closes the opening E when the oven is not in use. I and K are apertures for receiving any cooking vessels to be heated. L L² are compartments which may be used for warming plates; and M, M, M openings for cleansing the flues.

By these arrangements the oven is completely prevented from ever becoming too much heated at any one part; the heat is equally diffused throughout, and great facility afforded for converting the stove into an open or closed one at pleasure.

CORNES' UNIVERSAL PLOUGH.

(Registered Under the Act for the Protection of Articles of Utility. John Mangles, Turner, of Norwich Foundry, St. Andrew's, Broad-street, Norwich, Proprietor.)

Fig. 1.

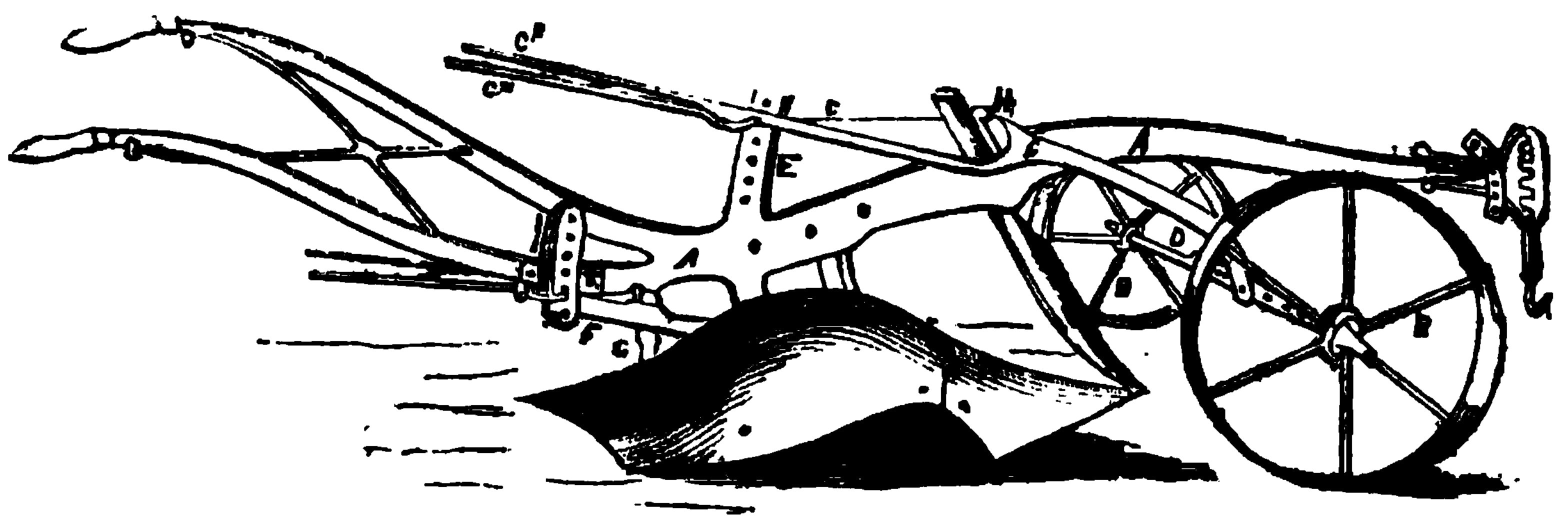

Fig. 2.

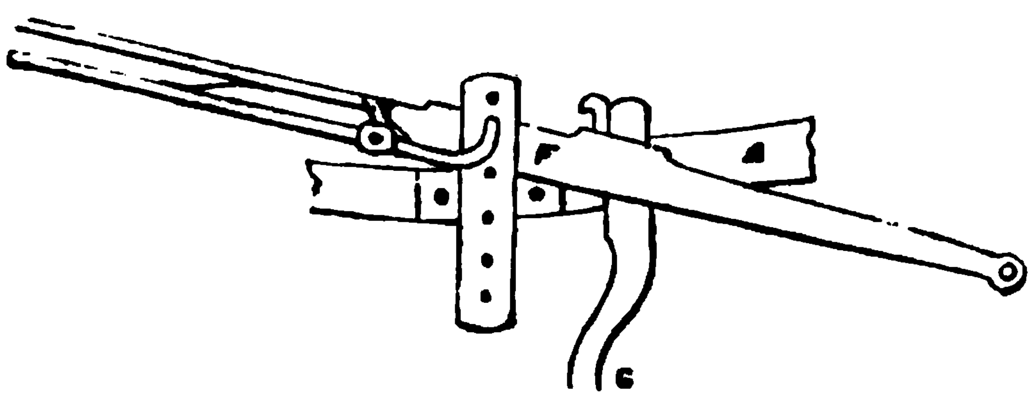

Fig. 3.

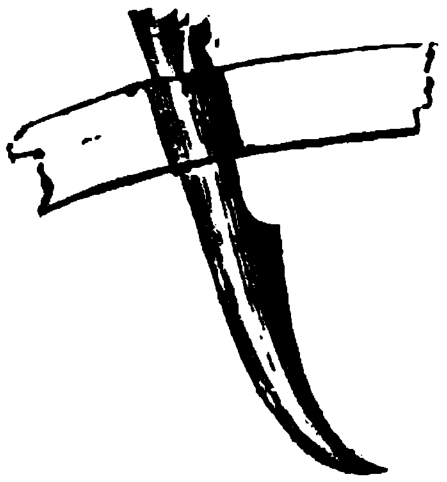

Fig. 1 is an elevation of this plough; A is the beam; BB the wheels by which the depth of the furrow is regulated; C is a lever which is connected by a pin or axis to the beam, A; D is the axle of the wheels, which is jointed to the lower end of the lever C, by a pivot, so that the wheels can adjust themselves to the inequalities of the surface of the ground. The upper end of the lever C, can be moved by the hand of the person attending the plough to any position required for raising or lowering the wheels, and in this position the wheels are fixed by a prong on the end of one of the handles C^2, Q^2, which takes into the arc E; which latter is affixed to the beam A. F is another lever, which actuates the prong, or tine G, for subsoiling, and causes it to assume any position required for entering more or less into the ground. The lever F, and its connections, are shown separately in fig 2. Fig. 3 is a cross section of the beam at the socket of the coulter, showing the manner in which the coulter is fixed by a semicircular wedge H.

The chief merits of this plough consist; first, in its enabling the ploughman to regulate the height of the wheels or the subsoil tine, without leaving his place or stopping the horses; and, secondly, in the coulter being more firmly secured than by any of the ordinary methods in use.

SMEE'S "ELECTRO-METALLURGY."—THIRD EDITION.*

Ten years have elapsed since Mr. Smee published the first portion of his Work under the above title; and the sale of two large editions of it, besides a translation into French, sufficiently attest the favour with which it has been received by the public. We have now before us a third edition, in

* "Elements of Electro-Metallurgy. By Alfred Smee, F.R.S. Third Edition. Illustrated with Electrotypes and numerous Wood-cuts."

which the author has brought down the progress of discovery and improvement in the important branch of practical science to which it relates, to the present day. All the old chapters of the work have been carefully revised, corrected, and (where necessary) enlarged, and two entirely new ones added, under the heads of "Electro-Disruptive Etching" and "Voltaic Blasting." The new portions are, like the old, distinguished throughout for originality and freshness—though this must be understood as having reference less to the matter than to the manner of the work. Mr. Smee's merit as a scientific writer consists not so much in the development of new facts, as in the presentation of new or but recently-ascertained facts, in a clear and popular style. Many of his facts, too, though not in themselves new, are at least new to scientific literature—having, till industriously collected by Mr. Smee, been confined to the individual knowledge of persons engaged in the different branches of the electro-metallurgic arts. We select the following specimens from the new portions of the work:—

Surface-Printing Electrotypes.

Electrotypes for surface-printing are found to be even preferable to the wood itself, as not only is the copper far more durable than the wood, but even the cupreous surface is found to print more beautifully.

Our friend *Punch* finds a copper face is suitable for his purposes, inasmuch as his title-page is electrotyped. Everybody reads *Punch*, and likes to see every person's follies shown up in a humorous point of view except his own; but his turn coming but seldom, he is perfectly satisfied to enjoy a laugh at other people, notwithstanding the occasional sacrifice of himself. From the artistic and literary talent employed upon this periodical, a very large sale is secured, and I am informed that between four and five millions of impressions have been taken from their frontispiece, which well shows how far a coppered face will serve, at any rate for surface printing. As *Punch* has amused his readers at my expense, he cannot complain at my endeavour to instruct mine at his.

I am also informed that the vignette at the top of the *Illustrated London News* is engraved on copper to print as a wood engraving. This wonderful periodical, which has done so much for the public in wood-engraving, has also an enormous sale; for nobody is satisfied without seeing the representation of every occurrence which takes place; and it is said that some copies of this vignette have printed at least three millions of impressions. Doubtless this journal would find the electrotype suit their purposes as well as the copper die. It is a curious fact that, at the present time, the great difficulty which is experienced by the large periodicals is, that of getting them printed to supply the public.

Multiplication of Daguerreotypes.

Mr. Horne, of Newgate-street, who is well known for his thorough knowledge of both the electrotype and daguerreotype processes, in answer to my inquiries, has obligingly favoured me with the following account of the best modern process of multiplying daguerreotypes. That gentleman states that as soon as the plan of Monsieur Fezeau, of fixing the image with a weak solution of chloride of gold in hyposulphate of soda, became known, the daguerreotype pictures assumed a much higher importance. That which before could only just be seen then became a firm bold picture, capable of being copied with ease. Great care, of course, is necessary to prevent the plate from being stained; therefore the metal must be deposited as rapidly as possible, and we must by no means allow the plate to remain in solution without galvanic action. The solution must also be very bright, and quite free from all foreign substances which can in any way attach themselves to the face.

The single cell, used in the following manner, will be found to answer best for commencing the deposition; but as soon as the plate is well covered, then it may be removed to an acid solution, and the deposit carried on by means of a battery.

Take a saturated solution of sulphate of copper, and having filtered it, as before described, and placed a porous tube containing the proper acid and water in the same vessel, unite the daguerreotype at the corner to a zinc plate by means of a wire having a binding screw at each end. The wire must be long enough to allow both zinc and picture to go at the same moment into their respective solutions, by which means galvanic action is instantly set up, and a deposition immediately takes place over the whole of the surface, without allowing time for the plate in any way to be acted on.

Care must be taken not to remove the plate too soon from the solution; but any air bubbles are best removed by allowing a stream of water for an instant to flow over the surface.

As soon as the required thickness has

been obtained, the zinc plates must be separated, and the original daguerreotype plunged into clean water to remove all traces of copper, and finally dried off in the usual manner, whilst the deposited copper should be protected as much as possible from the air.

With respect to the above account, I am of opinion that the battery process may be safely used throughout, if ample power is supplied at first by using two batteries in series.

Dr. Pring's Steel-Etching Process.

It is well known that when the connecting wires of a battery are brought together, a spark ensues, and portions of that piece of metal communicating with the silver, are transferred to that metal communicating with the zinc. To Dr. Pring is due the merit of having first brought this fact into practical use for the purpose of engraving the hardest steel. This gentleman fixes the plate to be engraved in a small hand-vice, such as is used by watchmakers; this plate is then connected with an electro-magnetic coil, which is again connected with the zinc of about half a dozen of moderate-sized platinised silver batteries. To another wire, attached to the platinized silver, is joined a wire of platinum or of gold, which it is found convenient to fix in a crotchet needle-holder. When this wire is brought into contact with the steel plate a portion of the latter is thrown bodily off and transferred to the etching tool, and thus by electro-mechanical skill a perfect device can be made upon the hardest steel.

If the plate and graver be attached to the reverse plate of the battery, then the wire is transferred, and a gold or platinum design is effected; but this result only takes place well in the purest steel, and the steel around the deposit is charred and burnt.

Dr. Pring's process is at present a scientific curiosity of high interest; it bears the same relation to the arts now as the first electro copies of penny pieces did many years ago; in it is involved, however, a new application of a scientific fact, and on being thoroughly worked out may be, for aught we can tell, applicable to the die-sinker and other branches of the arts, and is now applicable to imprint the most beautiful designs on swords and steel instruments of every description made of hardened steel, which would, by any other process, be difficult to engrave.

The electro-disruptive etching is totally distinct from voltaic etching. In the latter, the voltaic force assists chemical affinity, and the metal is dissolved. In the former, the aggregation of the particles of metal is interfered with, and portions are thrown out. In the one case we act, therefore, by interfering with the attraction of chemical affinity; in the latter, by interfering with the attraction of cohesion. This process was submitted to the Royal Society in 1846, and with the peculiar wisdom for which that greatest association of philosophers in Europe are particularly notorious in their corporate character, it was allowed to slumber; and from the circumstance of the inventor living in the country, it is even up to the present time but imperfectly known. The specimens which I have seen are extremely beautiful, and I hear that very interesting examples will be shown at the Great Exhibition.

To the Chapter on "Voltaic Blasting" Mr. Smee may add, with advantage, in his next edition, some notice of the similar application, by the Americans, of the electric agency to the firing of artillery and shells—though, to be sure, neither the one nor the other can be said to come strictly within the title of the work.

DWELLING-HOUSES FOR THE POOR.

Great good has been done by two societies which have been formed of late years, for improving the dwellings of the indrustrious and labouring classes.* The model lodging-houses constructed by them have been the means of imparting happiness and comfort to hundreds. In one for single men in George-street, Holborn, 104 individuals are accommodated with separate well-ventilated sleeping apartments; the drainage is perfect, the supply of water is ample; there are a kitchen and wash-house furnished with every convenience. The lodgers are charged only 2s. 4d. per week. In the pantry are 104 small meal-boxes, with keys attached, to one of which boxes each inmate is entitled, and where, on going out in the morning, he locks up his provisions till his return. There is a coffee or common room, 33 feet long, 22 feet wide, on each side are two rooms of elm tables with seats. It is in fact a *club-room* for the poor; where, after their daily toil, they may relax from their labour, and pass the evening in reading and conversation. Prayers are read nightly by the Superintendent, and twice a week by a Scripture reader.

* The "Metropolitan Association," for improving the dwellings of the industrious classes; and the "Society for improving the condition of the labouring classes," to which the "Labourer's Friend Society" is united.

There are several other excellent establishments of the same kind; for example, that built by the Metropolitan Society in Spitalfields, in which are lodged 234 single men, each having a separate bedroom with a large and comfortable coffee-room, kitchen, a lecture and reading-rooms; each lodger being charged 3s. per week; there is also a house recently fitted up in Hatton-garden, for 57 women.

But, whilst fully admitting the immense benefits that have resulted from these establishments, I must be allowed to express a doubt whether they are calculated to meet the wants of the *poorest* class of our fellow citizens. Many of the inmates of the lodging-house at St. George's, Bloomsbury, are mechanics and citizens earning good wages. Small as is the sum paid at these institutions, it is more than many of the poor can well afford. "It may also be questionable," says Mr. Roberts in his excellent essay when speaking of the lodging-house in Spitalfields, "how far the class of men for whom lodgings in such a neighbourhood are chiefly needed, will be really benefited by the luxuries here provided, and which but few men in full employment can have much time for enjoying .... In reference," remarks Mr. Roberts, "to new buildings for the labouring classes, the most rigid economy of arrangement, consistent with accommodation sufficiently spacious to be convenient and healthy; and the utmost attention to cheapness of construction consistent with durability and comfort, are essential elements of a really good and suitable plan. The architect should bear in mind that the rents which the working classes usually pay, though exorbitantly high for the wretched accommodation afforded to them, will only just yield a fair return for the outlay on buildings constructed for their express use, and fitted up with all the conveniences which is desirable that they should possess. Any expenditure on necessary accommodation, which involves an increase of rent beyond that usually paid by the occupants of such a class of dwellings, appears to be at least hazardous, and may jeopardize the whole or a portion of the interest to be fairly expected from the investment."* At Bath, I observe, that a model lodging-house is opened for forty persons, with separate beds, washing stands, cupboards, and boxes, with locks and keys for all; a coffee-room, sick-room, gas throughout, &c., with cooking and attendance; for 1s. 9d. per week. And it is said to be self-supporting.

It was well remarked by several of the witnesses before the Commission of Inquiry into the state of large towns, that in all suggested improvements in the dwellings of the poorer classes, the ultimate expense to the tenants must be fully considered. And again, as Mr. Austin the architect observed, although apart from the consideration of expense, the proper methods that should be pursued admit of little question, it becomes a matter of the greatest importance to consider how far such measures should be modified to suit the case of the poor.

It would seem at first sight, that wide streets and large lofty rooms would conduce most to their health and comfort. But this would not be the case unless sufficient extent of ground could be obtained, to build new tenements for the greater part of the occupants of the old ones. "If," continued Mr. Austin, "a wretched, densely-crowded district, were cleared away, and rebuilt on the system of wide streets and capacious houses, proper accommodation would then be obtained for only half the former number, and the rents per head would be consequently doubled; and it is clear that the original number must herd together, to reduce them to their former level. Thus, the evils of over-crowding would be increased by the very means adopted to prevent them—instead of attempting to disperse the inhabitants over large spaces; it appears to me that a given area should be made, to accommodate as great a number as possible, consistently with the health, comforts, and independence, of the tenants; and by judicious arrangements these advantages can scarcely be secured without such a sacrifice of space."

I would venture to suggest that instead of new buildings, rows of houses or courts, might in many instances be purchased; the houses be gutted, and well ventilated; and then let to the poor at a lower rent than they could obtain accommodation for elsewhere. It would be expedient, wherever practicable, that these separate houses should be thrown into one, as gain is thus effected in economy of light and water, and in facility of ventilation; and there is also the advantage of placing the whole building with its inmates under the care of a superintendent. If buildings of this kind were open for the poor in separate localities, they would have also the indirect effect of stimulating the landlords in the respective neighbourhoods to attend to these matters. They would be tempted to build better houses in the place of the present miserable dens, and to let them at more reasonable prices. It would be well if the opinion of some of the principal builders were taken, as to the best and most economical mode,

* The Dwellings of the Labouring-classes, by Henry Roberts, F.S.A.

whether of constructing new, or of adapting old houses; as habitations for the poor. Fancy, decorative houses, show-buildings are not wanting, but serviceable dwellings, erected at the least expense, compatible with health, comfort and safety.*

And such establishments, I could wish, when it is practicable, that the children might have space for, and be encouraged to join in those innocent sports and games, whilst they are conducive to bodily health, also exercise a salutary influence on the mind. Nothing can be more dangerous to the moral character than that vacuity of mind, and those inert moping habits which are too common amongst the children of the poor. We hear much of the fearful spread of juvenile depravity. How many a child would have been saved from ruin if in his infancy he had not been left to vegetate amid such scenes of pollution and of sin, as those described in these pages; how many a felon on the gallows, if asked to trace the course of his wickedness, would point to the scenes of his early life, as those where his moral nature was first blighted by vice; and those habits were formed which eventually led him to an ignominious death! Rescue, then—I would say to the benevolent and philanthropic—rescue your fellow-immortals from such temptations, save them from these hot-beds of bodily disease and moral degradation — teach them the blessings of comfort, order, decency: and you will reap your reward, not only in the gratification that your consciences must feel, in having saved fellow beings from misery and sin; but also in the increased security to property, and the additional stability of our institutions; which will result from the improvement in the manners and habits of the people. And, believe me, this attention to them will not be thrown away. I speak not of course of those unfortunate beings whose consciences are seared, and who have become callous to all the kindly influences of humanity; but, in general, the labouring classes will view with feelings of gratitude the interest taken in their state. The effect of kindness on them has been thus beautifully and feelingly described by Southey:—"Try the effect of goodwill and hope upon the man who has wrapped himself up in the covering of a reckless and stubborn despair, and you will see verified the old apologue of the sun, and the wind, and the traveller. His heart will open, like a flower that closes at night, and expands its petals to the morning sun. The better parts of his nature will be put forth like the tendrils of the sea-anemone, when it feels the first wave of the returning tide upon its rock." The gratitude which such feelings of sympathy with the poor cannot fail to evoke, constitutes the best defence of kingdoms; the firmest bulwark of thrones; the surest stay and support of national greatness.*

* An excellent opportunity for erecting new dwellings for the poor now exists in the neighbourhood of Farringdon-street. It was proposed some time ago to build a street connecting Farringdon-street with Clerkenwell, but the plan was never carried into effect: the ground remains unoccupied; and the arches which have been erected, serve for no purpose except as an occasional shelter to the poor in the neighbourhood, who are said in the summer often to sleep under them. Let this vacant spot be occupied with comfortable abodes for the poor; Field-lane and the other haunts of vice in the vicinity might then be demolished; and the landlords be induced to build better houses on their site.

* From a pamphlet by Montague Gore, Esq., just published by Ridgway, and eminently deserving of general perusal.

MEAT BISCUIT.

The *Galveston Civilian* states that a factory, with proper machinery for manufacturing meat biscuit, has been established in Galveston, Texas, by G. Borden, jun., and is called the Meat Biscuit Factory. According to the description, the meat is minced, then boiled till all the jelley or gluten is extracted; two pounds of this jelly, containing the nutriment of eleven pounds of meat, is then mixed with three pounds of flour, and baked till the five pounds are reduced to four. Each biscuit is then packed in pulverized biscuit of the same kind, in an air-tight case. The same journal says that the War Department have ordered a large quantity of this biscuit for the troops on the frontier; and it pronounces the article, and the process of making it—a new discovery.

All this may be a valuable discovery, especially for travellers across the western desert, and for troops stationed in quarters remote from sources of supply. And it may also be a valuable discovery for shipping, especially on long voyages, in furnishing a portable, agreeable, and nutritious article of food. But we beg leave to protest against the general novelty of the discovery, however *novel* it may be in Texas. This discovery was made in France, as early as 1830, if not earlier; and the article was then described as "animalized bread." The French journals described it; and stated that it had been ordered by the government for the armies in Algiers. In

the French mode of manufacturing it, all parts of an ox, excepting the *hair*, were reduced to their elements, and the jelly or gluten extracted. The bones, the hide, the hoofs, horns, intestines and muscular fibre, were decomposed by heat, and their gluten separated from the lime and all other substances. And this was described as economical, the hoofs, and horns, and bones containing much gluten, and being more valuable for this purpose than any other. To our unsophisticated Anglo-Saxon tastes, the Texan mode, in which good minced meat, fit for a change at breakfast, is alone used, may seem the most acceptable. And the very thought of eating bread made from hides, hoofs, and horns, or the raw material for shoes, buttons, hair-combs, and powder horns, might occasionally put a fastidious appetite to flight. But this is mere prejudice; for chemistry can easily convert any thing into any thing else.—*Philadelphia Ledger*.

So far as we have been able to gather information on the subject, we believe, that the French animalized bread was merely portable soup or gluten cakes. Mr. Borden's soup-bread is a different preparation, and he was granted a patent in 1851 for the same. He takes the very best quality of beef which can be found in Texas, and extracts the gelatine from it by a low steam heat. This is afterwards—in a state of spissatude—kneaded with flour or any kind of vegetable meat, into cakes, and baked slowly in an oven heated by steam. By using a high heat to extract the gelatine from the meat, a very unpleasant flavour is communicated to it, for the high heat sets a portion of the phosphorus contained in the bones free, and this gives an unpleasant odour to the extract. Mr. Borden carefully avoids this—his extract is of as fine a flavour as Liebig's portable soup, and the baking of it into cakes, along with vegetable substances, enables it to be carried with ease over mountain and sea, and tends to preserve it from atmospheric influence, so as to prevent putrefaction. In Texas beef is very cheap, so are fowls,—such as turk the chickens, &c. Of this kind of meat, the very best alone is used by Mr. Borden. The patent claim is for the combination of the condensed extract of meat mixed with vegetable flour, either unbaked flour or crushed crackers, and the whole baked into biscuits. We have eaten some of Mr. Borden's biscuit, made into soup, and liked it very well; an ounce of it made a hearty meal. The great object of Mr. Borden is to use the best and most healthy substances to make an unexceptionable animal bread. He thought at one time of locating himself in New York, but the cheapness of cattle in Texas presented a field for securing the best materials at a low price It is the quality of this *bread* which constitutes its essential value, and it is the ambition of Mr. Borden to make this a new and useful article of American commerce. For sea voyages and long overland journeys, we believe it to be a grand compact article of food, and the time may come, when it will be found in every house in our land, as a most excellent and cheap basis of our soups.—*Scientific American*.

STEAM NAVIGATION IN AMERICA.

[From the letter of a New York correspondent of the *Times*.

The improvements in steam machinery, as applied to the propelling of steam ships, will not compare favourably with those made in its other modes of application. It is still cumbrous, and in addition to its own weight cannot be used at all without a consumption of fuel that requires for its own transportation to any distance the capacity of what would a few years ago have been considered a large ship. This considered, the discovery of any improvement cannot but attract much attention, and a general interest has been lately manifested regarding the extraordinary performance of a new vessel, now running between this port and those of central America.

The *Prometheus*, as this steamer is called, left here on the 27th January, and reached Chagres in eight days and nine hours, during which passage she lay-to for sixteen hours in a gale of wind, from Chagres to Belize at the mouth of the Mississippi in four days and twenty hours. On her return, she left New Orleans on the 16th of February, and reached this port in six days, the distance run was 5,590 miles in nineteen days and five hours, during which time her whole consumption was only 450 tons of coal. This is asserted to be fully one-third less than any steamer of the same capacity (1,600 tons) ever used for the same time and distance. Her owner, Mr. Vanderbilt, who has had more to do with steam boats than any one else in this part of the world, considers her rapidvoyage not so much owing to the model and structure of the vessel as to an improvement which he himself introduced in her engines, and which renders them different from any ever before used in a sea steamer. Of their greater perfection he is so confident that he openly offers to wager 100,000 dollars that there is no ship afloat, under any flag, and none which can

be built within twelve months, having any other plan of engines of the same size in proportion to the capacity of the ship, that can beat her on *any* passage at *any* season of the year, using the same quantity of fuel. He frankly states what the peculiarity is, and it is already announced that several vessels now in process of construction are about being furnished with machinery on the same principle. The engines are "direct acting," and their principal difference from those in general use consists in their being inverted. Two very desirable ends are thus attained—one is, that the power acquired is much greater than it has heretofore been with the same engines when placed in the usual position; the other is, that by this alteration a great saving of weight is made in the machinery, inasmuch as some of the heaviest pieces are entirely dispensed with, by which means the cost as well as the friction are much reduced.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MARCH 27, 1851.

ASTLEY PASTON PRICE, of Margate, Kent, chemist, and JAMES HEYWOOD WHITEHEAD, of the Royal George Mills, near Manchester. *For improvements in filters.* Patent dated September 12, 1850.

The first description of filter which the patentees describe, is composed of a tubular length of textile fabric, drawn within itself and enclosed in a sheathing of network of less diameter, so as to cause it to hang in longitudinal folds. The filter is to be suspended from the supply pipe. To remove any deposit which may have accumulated in the interior after continued use, it is only necessary to draw the tube out to its full length, when the dirt, being then on the outside, may be easily washed or scraped off. A second arrangement consists in drawing one length of tubular fabric within another of similar length, so as to obtain a large filtering surface. This filter has both a supply and delivery pipe. A third description consists of a filtering bag drawn within itself, and enclosed in a sheathing of network of less diameter than the bag. This filter is suspended from a supply pipe in the same manner as the first. The patentees prefer to employ twilled fabric woven in the circular loom, for the purpose of making the above-described filters. The fabric may be composed of cotton, or flax and woollen yarns, or of cotton or flax and wool, carded and spun together, or of any combination of yarns of one of these materials, with mixed yarns composed of two or more of these materials. It is preferred, in weaving, to have the warp thread of cotton, and the weft of wool; but this particular arrangement is not essential, and may be reversed if desired.

JAMES NASMYTH, of Patricroft, Lancaster, engineer, and JOHN BARTON, of Manchester, copper roller-manufacturer. *For certain improvements in machinery or apparatus for printing calicoes and other surfaces; and also improvements in the manufacture of copper or other metallic rollers to be employed therein, and in the machinery or apparatus connected with such manufacture.* Patent dated September 19, 1850.

The improvements in machinery for printing calicoes, as here claimed, resolve themselves into a method of perfecting or finishing the edge of the "doctor," an instrument of steel or other suitable material employed for clearing or removing from the unengraved portions of the roller used in cylinder-printing machines the superfluous colouring matter. The edge of the "doctor" after continued use becomes irregular and uneven, and, according to the methods hitherto practised, has been kept perfectly straight (so as to ensure coincidence of contact between it and the entire length of the roller), by filing, and then finishing with a whetstone; which operations having to be performed by hand, required great nicety, and involved a considerable loss of time and consequently expense. These objections are obviated by the patentees' method, in which the "doctor" is fixed in a frame to which a reciprocating motion is imparted by any of the means in use for such purpose. During the traverse of the frame, the edge of the "doctor" passes between two or more circular grindstones, which are caused to revolve in opposite directions by bands from the same pulley. Both sides of the "doctor" are thus simultaneously operated on, and by shifting the grindstones (which are mounted in slotted arms, so as to be capable of adjustment), any required bevil or angle may be given to the opposite edges of the "doctor."

2. The patentees propose and claim the application of Nasmyth's Steam Hammer, for the consolidation, while in the moulds of the moulten metal (copper or its alloys) used for manufacturing printing rollers, so as to ensure in the casting, freedom from air-bubbles and other imperfections. The rapidity with which copper sets, or passes from the fluid to the crystallized or solid state, renders it desirable that the pressure employed for this purpose should partake rather of the nature of a blow or rapid percussive action, than that

it should be continuously exerted as is now generally the case when pressure is employed at all in making castings.

SAMUEL BRISBANE, of Manchester, pattern-maker. *For certain improvements in looms for weaving.* Patent dated September 19, 1850.

The improvements here claimed consist,—

1. In an arrangement of apparatus for applying a friction break to the fly-wheel of power looms of all descriptions, when the driving-band is shifted from the fast to the loose pulley by the impetus of the lathe; the break being made so far self-acting as to retire from contact with the fly-wheel when its momentum is overcome, thus leaving the loom at liberty to recommence working.

2. An arrangement of apparatus for stopping the loom by shifting the driving-band from the fast to the loose pulley, in the event of the failure or breakage of the weft.

HENRY JEREMI CHRISTEN, of Paris, engraver. *For improvements in cylinder printing.* Patent dated September 19, 1850.

This invention consists in a method of printing with cylinders, having the whole of their surfaces engraved in such manner that portions of the fabric under operation shall be left plain according to any desired pattern, whilst the other parts bear the impression of the figured surface of the roller; and this is effected by the employment of a blanket, parts of which are removed according to the pattern desired to be left plain. The patentee proposes to make the blanket of four or more pieces of any suitable fabric cemented together with gutta percha, and having outside a piece of woollen cloth, parts of which may be cut away to produce the unprinted portions of the fabric. In place of a blanket of this description, rollers or cylinders with suitable hollows may be employed. No claims.

JASPER WHEELER ROGERS, of Dublin, civil engineer. *For certain improvements in the preparation of peat, and in the manufacture of the same into fuel and charcoal.* Patent dated September 19, 1850.

The improvements here claimed have relation to a method of economizing the refuse of bogs, and dust, and mould, or "mull" of peat, and converting them into fuel or charcoal. The different waste portions are well mixed in a pug-mill, or by any suitable apparatus, after which they are fed into a trough, supported inside of an air-chamber over the carbonizing furnaces, by which it is thus considerably heated. A furnace is placed at the end of the air-chamber, and the products of combustion playing around it further increase the heat. A screw is placed in the interior of the trough, for causing the peat to pass from end to end of it. The peat when delivered from the trough is in an incandescent state, and in order to cool it, it is passed directly into a cylinder revolving in a tank partially filled with water, and the ends of which are conical, to admit of the body of the cylinder coming under the cooling influence of the water, without any danger of its getting admitted into the cylinder. The cooled and carbonized peat is delivered into a sack, or other suitable receptacle, by means of a screw thread in the interior of the cylinder.

A method of preventing the admission of air to the carbonizing furnaces is next described. A tank-shaped recess is formed for these furnaces, which are mounted on wheels to admit of their being run in under the air-chamber, and water is admitted into this tank until it reaches a little above the bottom of the furnaces, and thus effectually exclude the air.

WILLIAM ECCLES, of Walton-le-Dale, cotton-spinner. *For certain improvements in looms for weaving.* Patent dated September 19, 1850.

Claims.—1. The application of certain parts adjustable with respect to each other, and revolving uniformly (in such adjusted relative positions) during the ordinary operation of the loom—the one, however, becoming an abutment for the other, so as to effect a stoppage of the retrograde movement of the cloth, and thus cause a positive amount of recoil, capable of being varied as desired.

2. The use of an elastic medium, for the purpose of disengaging the driving click of such apparatus from its wheel.

3. The application of a spiral spring to the frog-piece, for the purpose of breaking the impetus of the different parts of the loom when suddenly stopped.

WILLIAM HENRY RITCHIE, of Kennington, gentleman. *For certain improvements in machinery for preparing and carding fibrous substances.* (A communication.) Patent dated October 10, 1850.

The improvements here claimed, consist—

1. In the application of steam, heat, or moisture to wool slivers while on the feed apron, and previous to their introduction into the carding-machine, so as to dispense wholly or in part with the employment of oil.

2. In heating the feed rollers through which the sliver has to pass to the carding-engine, by making the said rollers hollow, and admitting steam into their interiors.

3. In an improved construction of drawing-roller, in which the teeth are formed by

combining flutings with spiral ridges and grooves, and are also slightly hooked.

4. In preparing woollen yarns previous to their being spun by the mule or jack, by employing a series of rollers, so as to draw the yarns down to the required size before putting in the twist.

ALFRED VINCENT NEWTON, of Chancery-lane, mechanical draughtsman. *For improvements in dyeing yarn, and in manufacturing certain woven fabrics.* (A communication.) Patent dated March 26, 1850.

This invention, as claimed by the patentee, consists—

1. In weaving two and three ply ingrain carpets by a combination of parti-coloured warp and weft threads, arranged so as to unite in producing, when woven by the Jacquard or other mechanical means, a pattern, the figures of which shall correspond in colour with the colours of the warp and weft where they cross each other. By colouring the warp in lengths equal to those of the patterns required, and the order in which they occur, and using weft parti-coloured so as to correspond with the width of pattern required, figures of any shade or shades may be produced at pleasure. The yarns are coloured in the same manner for weaving three as two plies. The patentee observes here, that he is aware that parti-coloured warp and weft have been hitherto used, but that the combination of them in the manner described is new.

2. In dyeing yarns of different colours in different parts,—an operation not hitherto performed with the requisite degree of nicety,—the patentee employs a frame, having a reel at each end fixed in slides, and capable of being moved towards each other. The yarns are wound in skeins over these reels, and the frame immersed, in a vertical position to the required depth, in a vat of dye-water. In order to allow of the immersed portion of the yarns being thoroughly exposed to the action of the dye, the lower reel is slid upwards from contact with it, and the hank left suspended from the upper one till the required depth of colour is obtained.

New Use of India-rubber—To milk cows India-rubber bags are drawn over the cow's teats, which sit close enough to exclude the air, in the lower end of which metallic tubes are inserted, closed by taps; when the four are adjusted, the taps are withdrawn, and the milk streams from each teat into the pail, exhausting the whole quantity in the cow's udder in half the time it would take to milk in the ordinary way. It is a useful invention, against which no valid objection can exist, and likely to come into general use. The cost of a set (four milkers) is fifty cents. (2s. 3d.) When cows are stalled, a man can milk ten in fifteen minutes.—*Janesville Journal, U.S.*

Carbonic Acid-Gas Engine.—Professor Saloman, of Harrodsburgh, Kentucky, has successfully applied the entire power of carbonic acid gas as a substitute for steam in propelling machinery for every purpose. The power of this gas has long been known to chemists, but their inability to regulate and govern it, has prevented its use as a propelling agent. Professor Saloman claims to be able to controul it with perfect safety; and that it will afford a power equal to steam in one-fiftieth of the space, and one hundred part of the expense, dispensing with both furnaces and boilers. Experiments have recently been made in Cincinnati which are said to be entirely satisfactory.—*American Paper.*

Sheep-Washing Apparatus.—Considerable interest was excited yesterday on the Corn Exchange, by the exhibition of the Syphon Sheep-washing Apparatus —the invention of Mr. W. W. Fyfe. The animal is placed in a trough, and the shorter arm of the syphon being inserted in the stream or reservoir, a constant shower is furnished. The supply is of course regulated by very ingenious means. The advantages which such an apparatus will render to our agricultural friends it is impossible to over-estimate; the principal, however, being, as established by Mr. Fyfe, that the water is brought to the sheep instead of the sheep to the water.—*Caledonian Mercury.*

WEEKLY LIST OF NEW ENGLISH PATENTS.

Matthew Herring, of Tonbridge-place, London, sugar planter, for improvements in the manufacture of sugar and rum, part of which improvements are applicable to evaporation generally. March 24; six months.

Frederick William Mowbray, of the Borough of Leicester, gent., for improvements in machinery for weaving. March 24; six months.

George Guthrie, of Appleby, chamberlain to the Earl of Stair, and residing at Rephad-by-Shanraer, Wigtown, for improvements in machinery for digging, tilling, or working land. March 24; six months.

Thomas Hill, residing at Langside-cottage, near Glasgow, esquire, for improvements in wrought iron or malleable iron railway chairs. (Being a communication.) March 24; six months.

Peter Armand Le Comte de Fontainemoreau, of 24, Boulevard Poissonnière, Paris, France, and 4, South-street, Finsbury, patent agent, for certain improvements in mills for grinding wheat and other grain. (Being a communication.) March 24; six months.

Henri et Alexandre Six, of Wazaume les Lille, temporary of Paris, France, gentleman, for improvements in bleaching flax and hemp. March 24; six months.

Hector Ledru, of 28, Faubourg Poissonnière, at Paris, France, civil engineer, for improvements in heating. March 24; six months.

James Cheetham, junior, of Chadderton, near Oldham, Lancaster, cotton manufacturer, for certain improvements in the manufacture of bleached, coloured, or party-coloured threads or yarns. March 24; six months.

David Farrar Bower, of Hemslet, York, manufacturing chemist, for certain improvements in preparing, rating (otherwise called rotting), and fermenting flax, hine, grasses, and other fibrous vegetable substances. March 24; six months.

Edward Dunn, of New York, in the United States of America, but now residing at Montpellier-square, Brompton, master mariner, for improvements in reciprocating and rotary fluid meters. (Being a communication.) March 24; six months.

Samuel Holt, of Stockport, Chester, manager, for certain improvements in the manufacture of textile fabrics. March 24; six months.

Samuel Walker, junior, of Birmingham, manufacturer, for a certain improvement or certain im-

provements in the manufacture of metallic tubes. March 24; six months.

Thomas Hawkins, of Inverness-terrace, Bishop's-road, Bayswater, oilman, for improvements in brushes. March 24; six months.

Henry Stephen Ridley, of Vincent-square, Westminster, surveyor, and James Edser, of St. James's-terrace, in the said city, builder, for a safety hinge and certain apparatus for the detection of burglars and prevention of burglaries. March 24; six months.

Thomas Woods, of Portsea, Hants, upholsterer, and Robert Walter Winfield, of Birmingham, Warwick, manufacturer, for certain improvements in bedsteads and couches, or articles for sitting, lying, and reclining upon. March 24; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Mar. 20	2736	G. Wilkin	Alnwick	Self-acting watercloset.
,,	2737	J. M. Turner	Norwich	Corne's universal plough.
,,	2738	J. Dyke	Ipswich	Portable cooking apparatus convertible into a close or open stove.
21	2739	A. Graham	Glasgow	Gas cooking-range.
,,	2740	S. Scafe	York	Spur spiral winder.
24	2741	Newbould and Baildon	Sheffield	Balance table-knife.
25	2742	L. Foucart, M.D.	Glasgow, and St. James's-sq., London	Chest expander or spiral rectifier.
26	2743	D. and G. Greig	Edinburgh	Self-acting gauge for side-lever lithographic press.
,,	2744	J. Hynam	Princes-square, Finsbury	Safety-lid to a vertical square match-box.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Mar. 22	112	O. Oliver	John-street, Tottenham-court-road	Chimney-pot.
,,	113	W. T. Denham	Charles-street, City-road	Rosin box.
24	114	G. Jacobs	Cockspur-street	Stranger's Guide to London.
26	115	J. Gedge	Wellington-street, Strand	Safety lock and key.
,,	116	W. Ladd	Penton-place, Walworth	Adjustments for microscopes.
,,	117	W. Green	Richmond-road, Islington	Ventilator.

TO OUR SUBSCRIBERS AND CORRESPONDENTS.

The Supplement, containing Title and Index to our last Volume (delayed through illness) will be published on the 1st proximo, and may then be had, gratis, of the Publisher.

Mr. Firmin's ingenious plan for a life-boat in our next.

Mr. Bills' "Analytical Solution" shall have an early place.

"Suffolkiensis" declined; better adapted to some of the agricultural journals.

CONTENTS OF THIS NUMBER.

Specification of M. Lelong Burnet's Water-Purifying Processes—(*with engravings*) ... 241

Messrs. Main and Brown's "Treatise on the Marine Steam-Engine," vindicated from the Strictures of Mr. Rawson. By Professor Main ... 247

Mr. Frost's "Stame" ... 249

Description of Dyke's Registered Portable Cooking Apparatus—(*with engravings*) ... 250

Description of Corne's Registered Universal Plough—(*with engravings*) ... 251

Smee's "Electro-Metallurgy." Third Edition.—Review ... 251

Surface Printing Electrotypes ... 252

Multiplication of Daguerrotypes ... 252

Dr. Pring's Steel Etching Process ... 253

On Dwelling-Houses for the Poor. By Montague Gore, Esq. ... 253

Meat Biscuit—American and French Preparations ... 255

Steam Navigation in America.—The New Steamer "Prometheus" ... 256

Specifications of English Patents Enrolled during the Week:—

Price & Whitehead ... Filters ... 257

Nasmyth & Barton ... Cylinder Printing ... 257

Brisbane ... Weaving ... 258

Christen ... Cylinder Printing ... 258

Rogers ... Artificial Fuel ... 258

Eccles ... Looms ... 258

Ritchie ... Preparing & Carding 258

Newton ... Dyeing Yarns ... 259

New Use of India-Rubber—Carbonic Acid-Gas Engine—Sheep-Washing Apparatus ... 259

Weekly List of New English Patents ... 259

Weekly List of Designs for Articles of Utility Registered ... 260

Weekly List of Provisional Registrations ... 260

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1443.] SATURDAY, APRIL 5, 1851. [Price 3d., Stamped, 4d.

Edited by J. C. Robertson, 166, Fleet-street.

PLUMMER'S PATENT FLAX-BREAKING MACHINE.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

PLUMMER'S PATENT FLAX-BREAKING MACHINE.

(Registered under the Act for the Protection of Articles of Utility. Robert Plummer, Esq., Newcastle-on-Tyne, Proprietor.)

FIG. 1 is a cross-section; fig. 2 a longitudinal section; fig. 3 an end-elevation; and fig. 4 a front-elevation of a machine for breaking flax straw in which the peculiar novelties of configuration, about to be described, are represented. The same letters refer to the same parts in each figure. The flax straw to be operated upon is laid upon the table *aa*, and advanced between the fluted rollers *b* and *c*, the guide or back plate *gg*, causing it to bend round the underside of the roller *c*, and between it and the roller *d*; it then passes over the plate *x*, and between the rollers *e* and *f*, and finally out upon the lower table. Or the reverse may be adopted, the straw being laid upon the lower table, and passed out on the table *a a*. The dotted lines represent the straw, and the arrows the direction of its passage through the machine; in its progress it is crimped and bent so as to break and loosen the boon. Should the boon or shive of the straw not be sufficiently broken, so as to be easily separated from the fibrous portion, it may be passed through the rollers a second time, or as often as may be found necessary. Motion is communicated to the machine by a belt-pulley at one end of the bottom roller *d*, which gives motion to all the other rollers by means of the toothed wheels at the opposite end, and the intermediate stud-wheel *z*. The ends of the rollers have plain parts truly turned, which bear upon each other, so that the flutes of one roller work into the spaces of the adjoining roller, and leave a space for the flax straw to pass through. The pressure of the rollers upon the straw is regulated by levers and weights, so that it can be adjusted to any amount required.

The principal novelties in this machine consist; first, in causing the straw at each passage through the machine to pass three times through, between a less number of fluted rollers than usual; and, second, the adoption of the guide-plate *gg*, to compel the straw to bend round the middle roller, and so to break and loosen the boon more effectually than has hitherto been done.

The same, or an equal effect, may be produced by four or more rollers, one above the other, with a back and front guide-plates, to cause the flax straw to pass between each in succession, and other similar modifications may be substituted; but the arrangement above described is preferred, as being less complicated and more conveniently worked.

The result of these arrangements is a much more useful and efficient machine than any of those hitherto used by agriculturists, or others, for breaking flax straw and other similar purposes.

NAVAL ARCHITECTURE.—NEW METHOD OF FINDING THE DISPLACEMENT.

Enquiry.

Sir,—Will you have the kindness to inform me in what way the formula commonly used in ship-building to express any area bounded by a straight and a curved line is obtained?

The formula is

Area $= \left\{ A + 4P + 2Q \right\} 1/3^r$, in which the straight base being divided into any *even* number of parts and ordinates erected—

$A =$ the sum of the first and last ordinates.

$P =$ the sum of the even ordinates.

$Q =$ the sum of the odd ordinates; and

$r =$ the *common* distance between the ordinates.

I remain, Sir, yours, &c.

M. A

[Having referred this inquiry to a mathematical friend who is conversant with the subject, he has favoured us with the following "Answer."—ED. M. M.]

Answer.

The formula for which our correspondent asks a proof is that commonly used in ship-building to express an area bounded by a straight line and a curved line, viz.:

$$\text{Area} = \left\{ A + 4P + 2Q \right) \frac{r}{3},$$

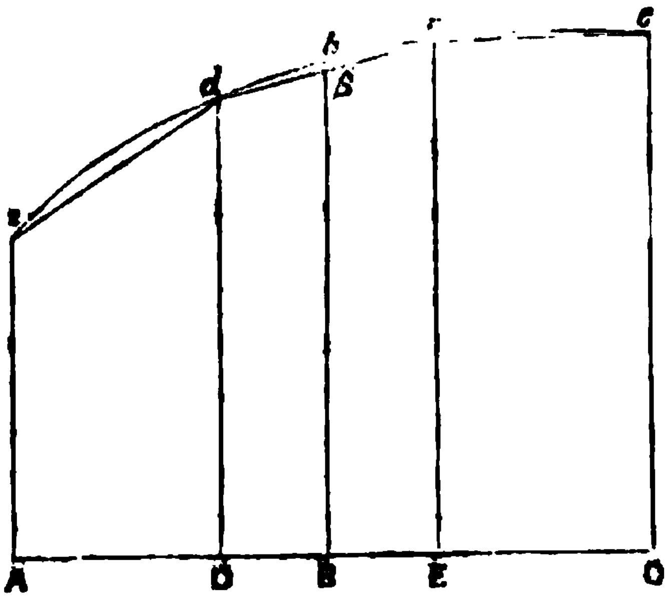
where A = Sum of first and last ordinates.
P = Sum of even ordinates.
Q = Sum of odd ordinates.
r = Common distance between ordinates.

The whole number of *ordinates* being *odd*, and the number of intervals being *even*.

The most simple, perhaps, is the following, which is given by M. Poncelet in his "Mécanique Industrielle."

Let Aa bcC be a portion of the area included between the curve abc, the line AC consisting of *two* of the *common* intervals r and the ordinates Aa, Cc: there being one intermediate ordinate Bb.

Divide AC into 3 equal portions in D and E. So that



$$AD = DE = EC = \tfrac{1}{3}(AC) = \tfrac{1}{3}(2r) = \frac{2r}{3}.$$

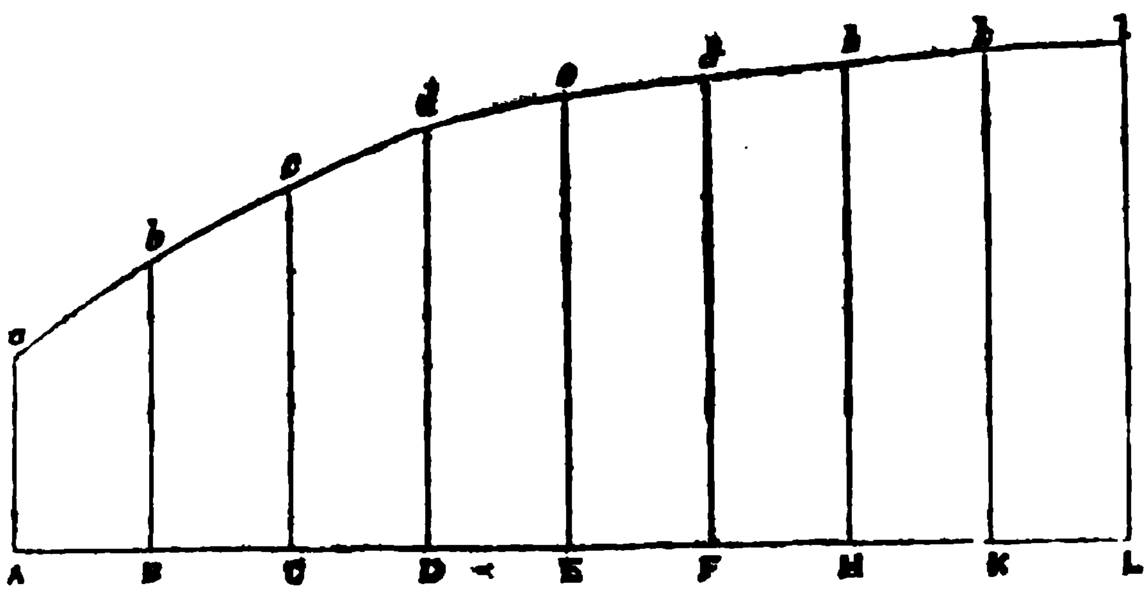
At D and E erect ordinates Dd, Ee. Draw the chords ad, de, and ec; let de cut Bb in β.

Then evidently, if the points a, b, c, be taken sufficiently near, the area abc CA will be very approximately represented by the sum of the three trapezia Ad, De, and Ec, the difference being the three spaces included between the curve abc, and the chords ad, de, and ec, which are of no appreciable magnitude compared with the whole area. Now the area of a trapezium having two sides parallel = ½ (the sum of the parallel sides) × perpendicular distance between them.

$$\therefore \text{Area trapezium } Ad = \tfrac{1}{2}(Aa + Dd)\, AD.$$
$$De = \tfrac{1}{2}(Dd + Ee)\, DE.$$
$$Ec = \tfrac{1}{2}(Ee + Cc)\, EC.$$
$$\therefore \textit{Approximately} \text{ the area } AabcC = \tfrac{1}{2}\{Aa + 2\, Dd + 2\, Ee + Cc)AD$$
$$\because AD = DE = EC.$$

Now $Dd + Ee = 2\, B\beta$, as may be easily proved $\therefore\ 2\, Dd + 2\, Ee = 4\, B\beta = 4\, Bb \because B\beta$ differs from Bb only by $b\beta$, which is of inappreciable magnitude compared with Bb: hence calling Aa, Bb, Cc, a_1, a_2 and a_3 respectively, and putting for AD its value ⅓ AC or $\frac{2r}{3}$ we have

$$\text{Area } Aa\, bcc = \tfrac{1}{2}\{a_1 + 4\, a_2 + a_3) \times \frac{2r}{3} = (a_1 + 4\, a_2 + a_3)\ \frac{r}{3}.$$



Let now the whole area whose magnitude is required be divided into any number of intervals similar to AabcC, *i.e.* into any *even* number of spaces, having therefore an *odd* number of ordinates; the common interval being r, as in the figure, and let the ordinates Aa,

Bb, Cc, Dd, &c., be $a_1, a_2, a_3, a_4, \ldots\ldots a_l$

$$\text{Then area CceE} = (a_3 + 4a_4 + a_5)\frac{r}{3}$$

$$\text{also EehH} = (a_5 + 4a_6 + a_7)\frac{r}{3}.$$

$$\&c. \quad = \quad \&c.$$

Adding, we obtain

$$\text{whole area} = (a_1 + 4a_2 + 2a_3 + 4a_4 + 2a_5 + \ \& \ + a_l)\frac{r}{3},$$

$$= \left\{a_1 + a_l + 4(a_2 + a_4 + a_6 + \&) + 2(a_3 + a_5 + a_7 + \&)\right\}\frac{r}{3},$$

$$= (A + 4P + 2Q)\frac{r}{3}.$$

Another mode of obtaining the same result is to suppose a *parabola* to pass through the extremities of every three successive ordinates; and to calculate the areas included between the line and these parabolas, and to take their sum as an approximate expression for the area required, which it evidently is, the spaces neglected being the areas included between the arcs of the curve and the parabolas. Let the given line be taken as axis of x, and the first ordinate for the axis of y, the rest of the notation being the same as before.

Then the general equation to a parabola referred to this pair of rectangular axes is

$$y = a + \beta x + \gamma x^2 \ \ldots\ldots\ldots\ldots (1).$$

where a, β, γ are constants to be determined by the condition that the parabola passes through the extremities of the three ordinates. And the area required

$$= \int_0^{2r} y\,dx = \int_0^{2r} (a + \beta x + \gamma x^2),$$

$$= 2ar + 2\beta r^2 + \frac{8\gamma r^3}{3},$$

$$= \frac{r}{3}.\left\{6a + 6\beta r + 8\gamma r^2\right\}\ldots.(2).$$

To determine a, β, γ

In (1) put $x = 0, r, 2r$ successively, and the corresponding values of y a_1, a_2, a_3.

$$\text{Then } a_1 = a \ldots\ldots\ldots\ldots\ldots (3),$$
$$a_2 = a + \beta r + \gamma r^2 \ldots\ldots (4),$$
$$a_3 = a + 2\beta r + 4\gamma r^2 \ldots (5).$$

Whence by virtue of (3) $4 \times (4) - (5)$ gives

$$4a_2 - a_3 = 3a_1 + 2\beta r,$$
$$\therefore\ 2\beta r = 4a_2 - a_3 - 3a_1,$$
$$\therefore\ 6\beta r = 12a_2 - 3a_3 - 9a_1.$$

Again $(5) - (4) \times 2$ gives

$$a_3 - 2a_2 = 2\gamma r^2 - a_1,$$
$$\therefore\ 2\gamma r^2 = a_3 - 2a_2 + a_1,$$
$$\therefore\ 8\gamma r^2 = 4a_3 - 8a_2 + 4a_1,$$

And from (3) $6a = 6a_1$.

Substituting these values of $6a$, $6\beta r$, and $8\gamma r^2$ in equation (2), we have the area between three ordinates

$$= \frac{r}{3}\left\{6a_1 + 12a_2 - 3a_3 - 9a_1 + 4a_3 - 8a_2 + 4a_1\right\}$$

$$= \frac{r}{3}\left\{a_1 + 4a_2 + a_3\right).$$

Similarly the area included by the next three ordinates beginning with a_3

$$=\frac{r}{3}\left\{a_3+4a_4+a_5\right\}.$$

&c. = &c.

Hence by addition (calling the last ordinate a_l) we have, whole area

$$=\left(a_1+4a_2+2a_3+4a_4+2a_5+4a_6+\&c+a_l\right)\frac{r}{3},$$

$$=(\mathrm{A}+4\,\mathrm{P}+2\mathrm{Q})\frac{r}{3}\ \text{as before.}$$

To apply this to calculating the *displacement* or of the ship immersed in the water, the volume is divided into portions by an *odd* number of planes parallel to the load water-line separated by a common interval, and by an odd number of planes parallel to the midship section; ordinates are measured at the intersection of each vertical and horizontal plane. The areas of the vertical sections are then calculated by the above rule, the interval between the ordinates in each being the common interval between the horizontal planes; these areas are then taken as ordinates to another curve, the common interval being that between the vertical sections. The area of this last curve is a very approximate value of the displacement. Dr. Woolley, Principal of the School of Naval Construction, H. M. Dockyard, Portsmouth, thinking it might be convenient sometimes to calculate the displacement by a shorter method, has furnished us with the following rule, which has, we believe, never before appeared in print, and has the advantage of giving the displacement by one operation in terms of the ordinates and intervals.

PROBLEM.—*To find the volume of any irregular solid contained between a surface, a plane, and four planes perpendicular to this plane, each plane being parallel to that opposite, and perpendicular to those adjacent.*

Suppose the solid divided into an even number of horizontal and vertical layers (the bounding plane being considered horizontal) by an odd number of horizontal and vertical planes. Let ordinates be measured at the intersection of each vertical and horizontal plane.

Let the ordinates in the upper or first horizontal plane be

$$a_1,\ a_2,\ a_3 \ldots\ldots\ldots\ldots a_{2n+1}.$$

.. .. .. second .. .. ..

$$b_1,\ b_2,\ b_3 \ldots\ldots\ldots\ldots b_{2n+1}.$$

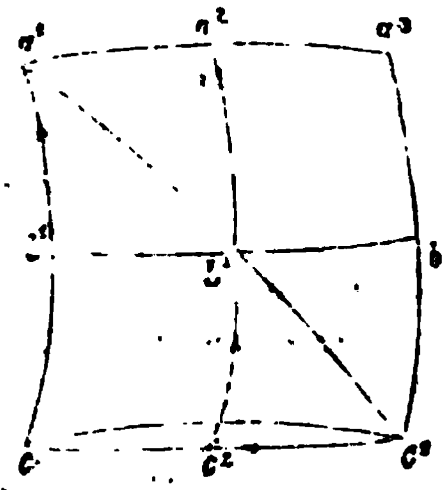
.. .. .. third .. .. ..

$$c_1,\ c_2,\ c_3 \ldots\ldots\ldots\ldots c_{2n+1}.$$

&c. &c.

Suppose $z=\alpha+\beta x+\gamma x^2+\delta y+\epsilon y^2+\zeta xy\ldots.$ (1).

to be the equation to a paraboloidal surface which passes through the extremities of six ordinates; the volume included between the bounding planes, and this surface, may be considered as approximately the same as that bounded by the given surface and the same planes.



Let $a_1a_2a_3$, b_2b_3, c_3, be the points through which it passes.

Let t be the tangent of the angle, at which a plane is inclined to the plane of zx (horizontal); the axis of y being vertical.

Then if V be the volume included between this plane, the plane of zx and the surface, and a plane parallel to yz, we have

$$\frac{d^2 V}{dx\, dt} = zx$$

("Hymers's Anal. Geom." 3 Dimensions, Art. 115)

$$= \alpha x + \beta x^2 + \gamma x^3 + \delta xy + \epsilon xy^2 + \zeta x^2 y \text{ by } (1),$$

(or putting $y = xt$)

$$= \alpha x + \beta x^2 + \gamma x^3 + \delta t x^2 + \epsilon t^2 x^3 + \zeta t x^3.$$

In integrating this expression, we must take for the limits of x, o and $2n$, and for those of t, o, and $\frac{m}{n}$ (m being the common interval between the horizontal, and n that between the vertical sections), in order to obtain the volume contained between the planes and the surface

$$a_1\ a_3\ b_3\ b_2\ c_3.$$

Effecting these integrations we have

$$V = \frac{2\,mn}{3}\left\{ 3\,\alpha + 4\,\beta n + 6\,\gamma n^2 + 2\,\delta m + 2\,\epsilon m^2 + 3\,\zeta mn \right\} \ldots\ldots (A)$$

and to determine the constants α, β, γ, &c., putting corresponding values of z, x, and y in (1), we have

$$a_1 = \alpha \qquad \ldots\ldots\ldots\ldots (2)$$
$$a_2 = \alpha + \beta n + \gamma n^2 \ldots\ldots\ldots\ldots (3)$$
$$a_3 = \alpha + 2\,\beta n + 4\,\gamma n^2 \ldots\ldots\ldots (4)$$
$$b_2 = \alpha + \beta n + \gamma n^2 + \delta m + \epsilon m^2 + \zeta mn \ldots\ldots\ldots\ldots (5)$$
$$b_3 = \alpha + 2\,\beta n + 4\,\gamma n^2 + \delta m + \epsilon m^2 + 2\zeta mn \ldots\ldots\ldots (6)$$
$$c_3 = \alpha + 2\,\beta n + 4\,\gamma n^2 + 2\,\delta m + 4\,\epsilon m^2 + 4\,\zeta mn \ldots (7)$$

(4) − 2 × (3) gives

$$a_3 - 2a_2 + a_1 = 2\gamma n^2 \ldots\ldots\ldots\ldots (8),$$

(3) × 4 − (4) gives

$$4a_2 - a_3 - 3a_1 = 2\beta n \ldots\ldots\ldots\ldots (9).$$

Also equations (5), (6) and (7) become by virtue of (2) (3) and (4)

$$b_2 - a_2 = \delta m + \epsilon m^2 + \zeta mn \ldots\ldots\ldots\ldots (10),$$
$$b_3 - a_3 = \delta m + \epsilon m^2 + 2\zeta mn \ldots\ldots\ldots\ldots (11),$$
$$c_3 - a_3 = 2\delta m + 4\epsilon m^2 + 4\zeta mn \ldots\ldots\ldots\ldots (12);$$

whence (11) − (10) gives

$$b_3 - a_3 - b_2 + a_2 = \zeta mn \ldots\ldots\ldots\ldots (13),$$

(12) − 2 × (11) gives

$$c_3 - 2b_3 + a_3 = 2\epsilon m^2 \ldots\ldots\ldots\ldots (14),$$

(10) × 4 − (12) gives

$$4b_2 - 4a_2 - c_3 + a_3 = 2\delta m \ldots\ldots\ldots\ldots (15);$$

whence substituting the value of α, β, γ, δ. ϵ, ζ, given by the equations (2), (8), (9), (13), (14) and (15),

$$\text{we get } V = \frac{2mn}{3}\left(a_3 + b_2 + b_3. \right)$$

Similarly volume passing the points $a_1\ b_1\ b_2\ c_1\ c_2$,

$$= \frac{2mn}{3}\left\{ c_2 + b_2 + b_1 \right).$$

Hence volume included between 3 vertical and 3 horizontal planes

$$= \frac{2mn}{3}\left\{ a_3 + b_1 + 2b_2 + b_3 + c_2 \right\}$$

If we take the volume between the same horizontal planes and 3 next vertical planes, beginning from the last just used, we have this volume

$$= \frac{2mn}{3}\left\{a_4 + b_3 + 2b_4 + b_5 + c_4\right\};$$

and so on for all portions included between the same 3 horizontal planes. ∴ by addition the whole volume included between 3 horizontal planes

$$= \frac{2mn}{3}\left\{a_2 + a_4 + a_6 + \&c. + a_{2n}\right.$$

$$+ b_1 + b_{2n+} + 2\{b_2 + b_3 + b_4 + b \quad + \&\}$$

$$\left. + c_2 + c_4 + c_6 + \& + c_{2n}\right\}$$

and the volume of a similar portion below (commencing from the lowest of these 3 horizontal planes)

$$= \frac{2mn}{3}\left\{c_2 + c_4 + \& + c_{2n} + d_1 + d_{2n+1} + 2\left\{d_2 + d_3 + d_4 + \& + d\ _n\right\}\right.$$

$$\left. + e_2 + e_4 + \& + 2_{2n}\right\};$$

and so on for all the lower portions. Hence, putting $l_1\ l_2\ l_3$, &c., the ordinates in the lowest section, we have volume of the whole solid,

$$= \frac{2mn}{3}\left\{a_2 + a_4 + \& + _{2n}\right.$$

$$+ b_1 + b_{2n+1} + 2\{b_2 + b_3 + b_4 + b + b_{2n}\}$$

$$+ 2\,(c_2 + c_4 + \& + c_m)$$

$$+ d_1 + d_{2n+1} + 2\left\{d_2 + d_3 + d_4 + \& + d_{2n}\right\}$$

$$\&c., \qquad \&c.,$$

$$\left. + l_2 + l_4 + \& + l_{2n}\right\}$$

$$= \frac{2mn}{3}\left\{(a_2 + a_4 + \& + a_{2n}) + (l_2 + l_4 + \& + l_{2n})\right.$$

$$+ 2(\overline{c_2 + c_4 + \& + c_2} \quad + \overline{e_2 + e_4 + \& + e_{2n}} + \&)$$

$$+ b_1 + b_{2n+1} + d_1 + d_{2n+1} + \&$$

$$\left. + 2\left(\overline{b_2 + b_3 + b_4 + \&} + \overline{d_2 + d_3 + d_4 +} \& + \&c.\right)\right\}$$

Whence the following Rule:—

Let the solid be divided into any number of *even* portions by an odd number of vertical and horizontal planes: and let ordinates be measured at the intersection of the planes—measuring *only* the *even* ordinates in the 1st, 3rd, 5th, &c., and every *odd* horizontal plane, and all the ordinates of the *even* horizontal planes.

Take the sum of all the even ordinates of the 1st and last horizontal planes for a first product.

Take the sum of all the even ordinates of the 3rd, 5th, &c., and all the odd horizontal planes except the 1st and last, and multiply by 2 for a second product.

Take the sum of the 1st and last ordinates of all the even horizontal planes for a third product.

Take the sum of all the ordinates except the first and last of all the even horizontal planes, and multiply by 2 for a fourth product, add these products together and multiply the sum by ⅔rds. of the product of the common intervals between the vertical and horizontal planes, the result will be the volume required.

The displacement calculated by this rule has been compared with that calculated by the ordinary method in several large ships (the displacement being between 3,000 and 4,000 tons): and the results have been found to agree within a fractional part of a ton.

An attempt was made to calculate the position of the centre of gravity at once from the ordinates: but although it met with success, the rule was so complicated, that it has not been thought advisable to publish it here. If the *displacement alone* be required, the above rule will give it with less than one-third of the labour required for calculating it by the ordinary rule, and in all cases it furnishes a test easy of application of the correctness of the usual calculation.

MR. SCOTT RUSSELL'S WAVE-LINE THEORY.

The same correspondent whose inquiries have elicited the preceding valuable communication, asks "Where he can find an account of Mr. Scott Russell's wave-line theory?"

We believe that Mr. Russell's views on ship-building have not been given to the public in any work, or in the transactions of any society. At least we have been unsuccessful in our search. We presume that they are founded upon his own experiments on "Waves," published in the Report of the British Association for 1844. His notion apparently is to accommodate the form of the vessel to that of the wave which it would tend to produce, so that no water should be *thrown up* in front as is generally the case. We believe that we are not far wrong in asserting, that the chief peculiarities of his method consist in giving to all the water-lines a cycloidal form, and in placing the principal transverse section containing the greatest breadth at a distance from the fore-end of the vessel, of three-fifths of the length, thus placing it *abaft*, instead of before the middle point of the length, as in the ordinary mode of construction. A pleasure yacht, named the *Titania*, was built, in accordance with his own views, by Mr. Scott Russell, for Mr. R. Stephenson; we have not however heard enough of its performance to warrant our hazarding any opinion as to the practical merits of Mr. Russell's principles of ship-building. In the absence of any published account of his views, we cannot vouch for the accuracy of our information: but are open to correction, if we have unintentionally fallen into error with respect to them.

GLEANINGS FROM THE UNPUBLISHED MSS. OF THE LATE BRIG.-GEN. SIR SAMUEL BENTHAM.

Hanging or Suspending Railroads, with Apparatus for Lightening the Loads upon them.—The apparatus for lightening the load to be on the principle of the counterpoise. These railroads are applicable to a great variety of services, both in the more easy conveyance and the moving about of heavy articles, whether for the storing or removal of them, or for the shaping them or putting them together.

Hanging railroads are applicable to the storing timber, and all heavy articles or packages requiring to be piled up one on the other in warehouses; to raising patterns or moulds out of the sand in a foundry; to raising the frames of ships; to bringing timber to a boring or shaping-apparatus; to the depositing large masses of stone for the construction of works of masonry; and in a covered dock or slip, the bringing, boring, chopping, or other apparatus, successively to that part of a ship's side where holes are required to be bored, or the timber chopped, &c., &c.

It is evident that, for such services as raising heavy masses of stone for the construction of a wall, the hanging railroad would be temporarily placed over the intended line of wall. So also for works at a ship's side; for instance, there would be no difficulty in placing a hanging railroad upon wheels, so as to make it moveable and subservient to works in different places.

Fishing Nets.—(From Notes made by Sir Samuel Bentham, during his travels in Siberia in the years 1781 and 1782). "Out of Russian linen, and even out of silk, the people of Yakutsk make nets for fishing. For this purpose they entirely undo the linen, so as to bring it again to threads—white and blue linen

only being used for this purpose. Of these threads they take one of blue, two of white, and twist them together, and with this make their nets. This mixture they judge to be the best colour for taking fish; and they prefer the thread thus reduced from cloth, on account of its softness as compared to thread which has not been woven. The meshes of their nets are from two to five vershok measured in the diagonal.

[It seems not an unreasonable supposition that colour really may render a net less apparent in the water: possibly the brown colour of tanned nets used in this country may cause them to be less distinguished by fish than a white one would be; different colours of nets might be worth a trial. The practice of tanning sails as well as nets by fishermen, and their very general opinion of its efficacy in rendering sail-cloth more durable, induced Sir Samuel, fifty-five years ago, to attempt the ascertainment of this point. His own observations had left little doubt in his mind that durability of sail-cloth, as usually manufactured, was thereby increased; but he conceived that the beneficial effect of the tan arose from its chemically decomposing either natural mucilage remaining in the cloth, or that artificially introduced by starching the warp preparatory to weaving. Depreciating useless expenditure and parade in experiments, he habitually had recourse to preparatory ones on a small scale. Those which he practised to ascertain the effect of tan on clean vegetable fibre may seem a little ludicrous, but they proved successful He caused a whole piece of linen to be carefully washed and rinsed, to divest it of all mucilage or other extraneous matter; the piece was then cut into two equal lengths, one half was left white, the other tanned in a strong infusion of oak bark in water; both varieties were then cut into drawers for his own wear; half of the set were made up having the right side tanned, the left side white; for the other half of the set this arrangement was reversed—the right half being white, the left tanned. He used no other than these drawers till they were completely worn out, when no difference whatever was found in the durability of the cloth —whether tanned or untanned. At that time neither lime nor soda for bleaching liquor were used in the laundry; besides that, particular care was taken that no deleterious agents of any kind should be employed in washing the subjects of this experiment, which was looked upon as conclusive. The frequent bad quality and short duration of the canvas used in the navy induced him to investigate the subject still further, particularly during a tour he made amongst manufactories in the year 1803. He found, indeed, that much of the sail-cloth obtained by contract was greatly injured by the use of lime—"old man," as it was called—in its preparation; but besides this, he became confirmed in the opinion that mucilage in sail-cloth causes rapid decay. He therefore induced a manufacturer at Castle Eden—Mr. Scarth—to weave sail-cloth *without* starch, after having freed the yarn from its natural impurities. A trial of this canvas was proposed to the Admiralty, and acceded to. Its quality, on trial, proved highly satisfactory; and, in consequence, it was intended that all required for the navy should, by degrees, be so manufactured. In a subsequent naval administration, a ropery and sail-cloth manufactory at Woolwich, which had been sanctioned by the King in Council, was put a stop to through the interested intervention of private manufacturers. Of late years, much sail-cloth is boiled in water, after being woven, to get rid of starch, &c. This has the good effect of washing out such impurities, but the texture of the web itself is necessarily less close than when woven without starch. It has been affirmed, too, by good authority, that canvas manufacturers of the present day are too much prone to follow the example set in the fabrication of other textile goods—that is, to substitute appearance of good quality in lieu of real strength. The safety of vessels at sea, when under sail, depends materially on the goodness of their canvas; so that investigation into its quality, the causes of its superiority or inferiority, and the means by which it might be improved, cannot be otherwise than of real importance to our mercantile no less than to our royal navy.]

Mallets.—Caulking and other mallets—why not made of metal as castiron? If made of about the same weight in proportion to dimensions as those at present of wood, the effect of the blow would be the same, excepting as to the yielding of the mallet, which yielding it is, that prevents the head of the caulking iron from being damaged. Perhaps if the metal mallet were made hollow, and without one of its ends, wood might be driven into that end, and be replaced as often as necessary. (1802.)

Masts.—To do away with the inconsiderate practice of overstraining masts by the tautness of rigging, the support to topmasts is insufficient. With a view to safety against dangers arising from the impulse of the wind on the sailing appa-

ratus, each subordinate part should break or give way, rather than that of next greater importance; and that the whole should break or give way rather than upset the vessel itself.

Felloes.—Since it is so well known that timber is much stronger in the direction of the grain than across it, how does it happen that the felloes of wheels continue to be grain-cut?

[The bending of timber into felloes appears, from a letter of Sir Samuel Bentham's, to be an easy process. In reply to a question of his brother Jeremy, he said, October, 1780:—"The making the circumferential part of a wheel of one piece bent round, for which Viney had a patent, has been practised time out of mind in the interior parts of Russia and Poland. There is not a wheel of a peasant's cart but what is made in this manner. I took care to see the process: pieces of 3½ inches are bent to a circle of between three and four feet diameter, though quite straight before."]

Procurement of Fresh Water at Sea in Hot Climates.—The excessive cold produced by evaporation on exposure of water to a current of hot air, is turned to account in the Benares ice-making process, and might be on shipboard in hot climates, for the production of fresh water. For this purpose shallow porous vessels should be filled with sea-water, and as it freezes taking out the ice.

The crystallization of the fresh water might be hastened, could a little pounded ice be thrown into the water as soon as cooled down to 28°, at the same time stirring it gently.

MESSRS. GARTON AND JARVIS'S REGISTERED CONVOLUTE BOILER, FOR HEATING HOT-HOUSES, CONSERVATORIES, PUBLIC AND OTHER BUILDINGS, BY STEAM OR HOT-WATER CIRCULATING THROUGH PIPES.

(Messrs. Garton and Jarvis, of 198, High-street, Exeter, Manufacturing Ironmongers, Proprietors.)

Fig. 3. Fig. 2. Fig. 1.

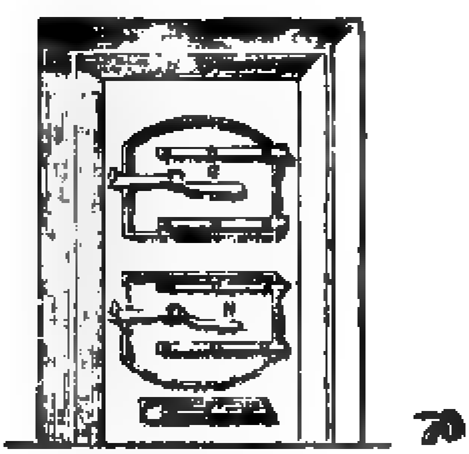


Fig. 1 is a front elevation of this boiler, with the fire-door frame removed; fig. 2 is a side elevation, and fig. 3 a front elevation of the fire-door frame. AA is the boiler, which is of a convolute, or scroll form; BB, the fire-bars; C a draw-off cock; D, the flow-pipes; EE, return-pipes; FF, connecting-pipes, through which a free circulation is afforded to the fluid from one part of the boiler to the other; G the fire-door, and H the ash-pit door. The dotted lines in fig. 1 indicate the outline of the brickwork flue, and the arrows, the course traversed by the heated products of combustion, which it will be observed circulate round the whole exterior surface of the boiler before passing off into the chimney.

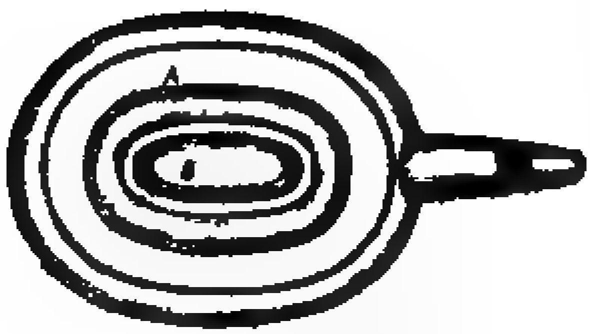
A boiler of this construction is particularly adapted for heating, by circulation of hot-water, conservatories, forcing-houses, and other buildings of large area.

MESSRS. PERKINS AND SHARPUS'S REGISTERED COPPERS, POTS, KETTLES, ETC.

(Messrs. Perkins and Sharpus, of Ball-court, Cannon-street, Proprietors.)

Fig. 1.

Fig. 2.



ongitudinal and vertical
2 a plan of a kettle con-
ig to this design. The
f a series of ridges, AA,
, by which the amount
d to the fire is greatly
he heated vapours are
i contact with it and the
metal.

The utility of this design consists in the great economy of fuel realized by it, and the expedition with which it effects the heating of fluids.

HINTS ON THE ECONOMY OF COOKERY.

Much of the economical and savory cookery of the Continent would doubtless be adopted in this country were coal fires as suitable for the purpose as are those of wood; that is, were it possible with a coal fire to maintain, without waste of fuel, a gentle heat for a great length of time. It needs only that the requirements in a stove for coals should be pointed out to British ingenuity, for the production of a stove having all the advantages combined of fireplaces for wood or coals.

In great kitchens a gentle heat is obtained by means of hot plates, and some attempts to attain the advantages of them have been introduced in cottage stoves, but it has been by the sacrifice of an open fire. The cheerfulness and salubrity of an open fire ought not to be dispensed with; besides, it is essential to roasting in perfection. Without entering into details of construction, it may be indicated, that the fireplace of an improved cottage, or cooking stove, should present the largest possible *open front* of fire, with no more depth from front to back than just sufficient for the fire to burn brightly; M. Soyer's roasting fire, at the Reform Club, is said to be but 4 inches deep; Count Rumford's stoves were no more at the bottom. The proposed fireplace, would of course have its sides and back of fire-brick, or other non-conductor of heat.

Instead of allowing the products of combustion to go straight up the chimney, they might be conveyed from one side of the fireplace along the back of it under a plate to the other side of the stove, there to be carried off by a flue-pipe; thus a large surface of hot plate would be formed either for cooking purposes or for warming the apartment as by a close stove. Heat transmitted through a plate, not being sufficient for some purposes in cookery, the plate might have apertures in it for exposing vessels to the open fire, these apertures having covers to them fitting into grooves filled with sand in the usual way.

Roasting, boiling, and frying being thus provided for; the next object is that of facilitating the economical and perfect confection of soups, stews, hashes paste, and other preparations that require a long-continued but gentle heat. The first-rate French cook, like the humble peasant's wife, in preparing the *pot-au-feu* (the daily soup) causes the pot with its contents to boil quickly at first, and throw up its scum, which being carefully taken off, the vessel is immediately removed from the fire to the gentle heat afforded by embers or hot ashes; good housewives cover up the wood; all cooks leave

the soup to simmer for several hours, never to boil. So little attention is required after the first skimming, that the cook leaves the soup whilst she makes her marketings, and the peasant betakes herself to her ordinary labours. By this gentle simmering the flavour of the ingredients is retained in the soup, the meat itself, the *bouillie*, instead of having become, as it usually is in England, a mass of tasteless tough fibres, is tender and delicious. It is from the introduction of this wholesome mode of making a small portion of butcher meat go far, that the greatest improvement in cheap English cookery may be expected; and it is the object of the proposed improvement of stoves to enable a coal fire, without waste of fuel, to give a long-continued equable heat to soups, stews, hashes, &c.

In order to effect this purpose, the fire-front might have doors or slides to close it more or less, or entirely at pleasure, and provision should be made for regulating the admission of air to the fire more or less, as might be required to keep up the quantity of fire desired. Like the Arnot stove, the whole exterior of the cooking stove should be a double casing, leaving a space between the interior and exterior case to be filled in with sand. Thus, as in the Arnot stove, loss of heat from the exterior might be prevented and the degree of heat be made capable of nice regulation, so that vessels might be left to simmer gently upon the top plate or over one of its apertures, according to the force of fire required for other purposes; in this way, equable gentle heat would be as well attained as by means of the embers or ashes of a wood fire. The farther convenience would result, of having the fire always in a state of readiness to be suddenly encreased by the admission of an additional volume of air; indeed, were the fire kept burning night and day, as in an Arnot stove, the coal consumed during the night, need not exceed in value that of the wood usually employed in lighting the kitchen fire of a morning.

Such a fireplace would not suffice for ventilation, if no otherwise open to the chimney than by a pipe for carrying off the products of combustion; and the steam and scents from cooking would be thrown into the apartment, were the chimney wholly closed up excepting by the pipe. To obviate such inconvenience where the saving of a little expense were important, the chimney might be left open, but it would be better to close it with a plate of metal having in it a register flap: this register, instead of being square or oval, should be narrow, and run along at least as far as the whole length of the top of the stove, and this register-flap should be easily openable more or less at pleasure.

Now that ovens and water-boilers have become so general, the omission of them in such an apparatus may be looked upon as an insuperable objection to it; but while admitting the great convenience of both oven and boiler, a little reflection would hardly fail to convince the greatest admirers of them that they are wasteful, in small families. In great kitchens, where hot water is in constant demand, and an oven in nearly continual use, they are little objectionable, but otherwise heat is uselessly flying off from the oven the whole day, though its services be required for no more than an hour or two; the water boiler is still more extravagant, on account of the heat consumed in forming steam, for no other purpose than to go up the chimney. These fixed boilers have the disadvantage, too, of being long in heating, so that when boiling water is wanted on a sudden the teakettle is had recourse to habitually. Without pretence to accurate experiment, experience has indicated, that fewer coals were used in an old-fashioned large open range, than are now consumed in a snug modern one having an oven and a boiler; which can only be attributed to the loss of heat occasioned by the oven and boiler. On this account neither oven or water-boiler are proposed for the improved stove; were bread to be baked, the cheaper way would be to heat a separate oven expressly for this purpose; for boiling water for ordinary purposes a detached kettle might be fitted to enter one of the apertures in the top plate of the stove, and for great washes a common copper is the best and cheapest mode of heating water. A portable bottomless oven placed upon the hot plate would bake small articles; the oven being of double plates of tin or other metal, including air between them as a bad conductor of heat.

To broil in perfection, the meat or fish, instead of being exposed to the smoke and flame of an open fire, should be laid

on a plate of metal over an aperture of the hot plate, this broiling plate being constructed specially for the purpose; it should have projections downwards, to keep it in an inclined position for fat and gravy to run down as formed, otherwise the meat would be fried, not broiled. The lower part should be furnished with a margin to retain the gravy as formed, and the fat as melted. A broiling plate of this kind is a desideratum as an article of kitchen furniture where common open fireplaces are in use.

Other operations than cooking are occasionally carried on in the kitchens of second-rate and smaller houses—such as a little wash of muslins, airing linen, drying towels, glass-cloths, &c. Drying is usually effected by hanging wet things in front of the fire, throwing damp into the room, and with no small danger of conflagration. Instead of this mode, a foreign one might be imitated—that of placing articles to be dried or aired immediately over the source of heat; for this purpose a bottomless hamper-like basket is provided, having a wicker grating across it more than halfway up, a pan of hot ashes or braise is put under the basket, the articles to be aired above it on the grating. A similar airing-apparatus would be very useful in this damp climate, and charcoal might be substituted for the braise; but in the proposed fire-apparatus a metallic grating might be made to slip into a groove, or to hang upon hooks at some distance above the hot plate; articles laid upon the grating would be expeditiously dried or aired without danger or annoyance: of course a time would be chosen when little or no cooking was going on. Smoothing irons would heat upon the hot plate as well as upon an ironing stove. It may be remarked on this subject, that ironing stoves would be much improved were a rim formed round them to support a bed of sand on the top, the iron when put to heat being forced into the sand till in contact with the stove; this was seen in practice with good effect half a century ago, and lately in France.

Most of the proposed arrangements may already be found in one or other of existing stoves or ranges, the only novelty being that of combining the several advantages with a view to affording means for containing a slow fire for cookery for a great length of time, and at small expense, and thus to make a coal fire answer as well as one of wood for economical cookery. It is evident that stoves, of the description proposed, might be made of various sizes, from that of one suited for the humblest cottage to the kitchen where a considerable variety of meats might be occasionally required; but Count Rumford's experiments proved that where large quantities, or great variety of meats have to be prepared, two or three separate fires are less wasteful than one large one.

The extravagance of our common open fireplaces for cooking was exhibited so long ago as by Count Rumford, in his Sixth "Essay." He ascertained by careful experiment that no less than seventeen-eighteenths of fuel are lost in boiling water on a common fire, compared with boiling it in a stove of his contrivance; but that even by that better mode one-third of the heat was supposed to be lost comparing his best experiment with the experiments on heat by Dr. Crawford.—(*See* p. 141, of the Count's "Essay.")

M. S. B.

PHOTOGRAPHING IN NATURAL COLOURS.

(From the *Daguerreian* Journal of New York.)

We are now called upon to notice the greatest and most valuable discovery that has been presented to the public since the announcement of the Daguerreotype by Daguerre, and the Telegraph by Morse. With these names we now add another, of one whose great perseverance and energy has ranked him with the first discoverers in the world. This gentleman, like Daguerre, has given much time and manifested much skill in conducting his experiments, and is entitled to great credit.

L. L. Hill, of Westkill, this State, has discovered a process of producing impressions upon metallic plates, with all the "colours of nature;" and as the process is "essentially different from Daguerre's," and wholly unlike all others, we will (as it has been left with us to "christen") name it "Hillotype."

We are led to believe that the Hillotypes will supersede the Daguerreotypes, as the former will be altogether preferable. The discoverer has produced copies of coloured engravings, "true to the tint." Each particular shade is presented with all the softness in nature or art, and marked with a delicacy and brilliancy which no pen can describe and no imagination picture. They are unlike a Daguerreotype as they can be;

seen in any light, and possess beauty that no artist can paint, while at the same time they present Nature as she is.

We feel convinced of the durability of the Hillotypes, from the fact that two impressions have been, for four months past, exposed to the direct rays from the sun, on an average of about six hours per day; these pictures have undergone no perceptible change; and from this we conclude that they are equally durable with the Daguerreotype. In the practice of Mr. Hill's discovery there will be required similar care and skill to that required in that of Daguerre's. Mr. Hill, in one of his communications to us, says, "My process involves the use of, at least, one substance *entirely new;* which, though it is my own discovery, I cannot name, and is unlike anything ever named by chemists." We are led to believe that the world will be *as much* astonished at the means employed as at the beauty of the results. This gentleman is desirous of perfecting his process so far that in a few hours a skilful Daugerreotypist may gain a full knowledge, and be enabled to operate successfully; and he has strong hopes that, in a few weeks, he will be enabled to work with certainty, and produce "instantaneous impressions." This last will be a great advantage; as then we shall be enabled to produce a faithful counterpart of children, which will, in this particular, prove an invaluable discovery. We predict that the Hillotypes will not be confined to the taking of likenesses, but extend to the production of *views* from nature, in a form more extensive than has heretofore been dreamed of. Think but for a moment of a view, five feet square; what must be the value of such a picture, in which all the "colours of Nature" are faithfully represented, and it is out of the reach of art to copy? We conclude for the present, and look forward with interest to that hour when Mr. Hill shall have made the proper arrangements, and secured to himself the right and reward to which he is so justly entitled. *Let this be distinctly understood, that this process will not be monopolized;* but be placed within the reach of all worthy Daguerreotypists and artists.

We should say, that some little difficulty has been experienced in producing one colour (the yellow); but now it has, in a measure, been obviated, and not a particle of doubt remains but that all colours *have been* and *can be again produced* by the Hillotype process. The following communication will be received with interest:

The Natural Colours.

Mr. Editor,—It has been pretty widely circulated, that I had discovered a process for photographing in colours. The facts are these:—Some two years ago I took to experimenting, with a view to this great desideratum, but with little faith; in one of my experiments a phenomenon presented itself which greatly surprised me, and, in the nature of the case, compelled me to believe the thing practicable. One colour, the *red*, in a figured dress, was developed as bright as a ruby. I then repeated the experiment, and failed; but, from that hour until a few months ago, I continued to repeat it in every form I could think of—always failing, but never despairing—for I had reasons for believing in the correctness of my theory, that, *under certain circumstances*, there is on the impressioned plate a *latent-coloured image*. I at length commenced experimenting on the *developing power* of the vapours of different metals, and found that a large number of them,—such as arsenic, padmium, zinc, selenium, bismuth, potassium, and sodium,—would, when properly vaporised, bring out the latent image in light and shade. The same result followed the use of several gases. The impressions differed so little from Daguerreotypes, that I was on the point of abandoning the pursuit; when I one day unexpectedly formed a singular compound, and, without much hope of success, applied it to my purpose.

My surprise and joy were unbounded when I found on my plate a true Hillotype.* The same process, with some variations, I have followed since, always with good results. I now have forty-five specimens, all of which present the several colours, true to a tint, and with a degree of brilliancy never seen in the richest Daguerreotype; and this is true also of the whites and blacks. The pictures have much the appearance of *enamelling*, and I believe are equally durable, for it is very difficult to efface them by scouring; and, as far as I can judge, they are not acted upon by light. My process bears no resemblance to Becquerel's, and is essentially different from Daguerre's.

My success in *quickening the plates* has been equally gratifying; and I have but little doubt of being able to operate in diffusing light *instantaneously*, having already reduced the time of sitting to much less than that required for Daguerreotyping. I shall continue experimenting until I have perfected the discovery as far as I can; when I shall secure my right, if possible, by a *special patent*, and offer the process for sale, on reasonable terms, to all worthy Daguer-

* We substituted the word Hillotype in place of the one inserted by Mr. Hill.—Ed. D. J.

reotypists. Several eminent artists, from Philadelphia and other cities, who have visited or corresponded with me, advise me to this course. I have been offered 20,000 dollars for an interest of one-half; but whatever disposition I may make of it, it *shall not be monopolized.* I am told, by those well qualified to judge, that my discovery will completely supersede Daguerreotyping; but it may be well to state, that very few of the appliances, or manipulations of the Daguerreian-room, will have to be dispensed with.

With best wishes for your success,
I remain, fraternally yours,
L. L. Hill.

Westkill, Green Co., New York,
January 17th, 1851.

MR. FROST'S "STAMB."

Sir,—Your correspondent—an "Impartial Observer"—thinks I have overlooked "a most palpable error" in Mr. Frost's calculations relative to the value of his improvements in steam engines. This is not a just charge in respect either to Mr. Frost or myself. An "*Impartial* Observer" ought not to have taken that title until after he had exercised at least that ordinary care to avoid mistakes which is due from every one who claims the time and attention of others. He says that the actual pressure of the steam in the first experiment ought not to have been estimated at 12 lbs., but at 33 lbs. on the inch—the steam being 21 lbs. and the vacuum 12 lbs. Now it is your correspondent who is to be accused of oversight, for he has overlooked the fact, that the steam is stated to have been exhausted during the course of the first experiment, although at the commencement there existed a pressure of 21 lbs. Mr. Frost therefore very properly—at least without any numerical error—took the pressure against the vacuum, or 12 lbs. as one of the terms of the ratio that was to indicate the comparative results. During the second experiment the steam rose from 21 lbs. to 37 lbs, which, plus the vacuum, made 49 lbs. for the other term of the ratio. These, therefore, win the two extremes of the force acting on the piston at the termination of the two experiments and the ratio of 49 to 12 as employed by Mr. Frost, and not that offered by your correspondent of 49 to 33, is, accordingly, the correct statement. It was, of course, an improper datum for calculation; but the error is not more strange than the oversight of "An Impartial Observer."

I am, Sir, yours, &c.,
Benj. Cheverton.

DISCOVERIES AND IMPROVEMENTS ENDLESS.

The arts are like plants, proliferous, and like them, too, can only be improved by culture. The transformations wrought by horticulturists and promologists are all but incredible. Peaches were originally poisonous almonds, and used to impregnate arrows with deadly venom. Cherries are derived from a berry of which a single one only grew on a stem; nectarines and apricots are hybrids of the plum and peach; the chief of esculents, with its relatives, broccoli and cauliflower, come from a marine plant, from the common sea-cale, which shoots up on some sandy shores. From wild sour crabs, scarcely larger than boys' marbles, have proceeded all varieties of apples. The largest and richest of plums are descendants of the blackthorn's bitter sloe. Such are mere specimens of vegetable metamorphoses brought about by transplanting, acclimating, crossings, and culture.

It is much the same with the fruits and flowers of art. They are nothing till improved by cultivation; and from very humble and ignoble sources they, too, spring. A fowling-piece is a child's pop-gun elaborated; clay huts were the germs of our marble mansions; a ship is a ripened canoe; and the steam-engine itself may be traced to covers ejected from primeval cauldrons. The highest elegancies are descendants of very homely progenitors. Our ladies adjust their shawls of cashmere before glass mirrors supported by Psyches; primitive belles covered their shoulders with skins of newly-slain animals, and admired their unctuous faces in pans of water and polished stones. A Jacquard loom is an Indian's weaving frame matured: and printed volumes are deducible from quipos and historic belts of wampum. Like plants, inventions grow and multiply, and to congenial minds present a class of varied beauties, captivating as any with which amateur and professional florists are charmed.

Newly acquired truths in physics are keys, each of which unlocks a world of wonders. Every new art gives birth to a thousand. The range of discovery is undoubtedly illimitable — a truth that has only dawned recently with full conviction even upon savans. A century ago few minds were prepared to receive it, and fewer to act on it. Pregnant with hope, with present and prospective acquisitions, it is among the divinest of modern convictions. Navigators have added, some islands, others continents, and the woolcomber's son of Genoa gave a hemisphere to geography. This done, comparatively little was left of the earth's surface to explore. It is not so with science,

nor the applications of science. In them fresh additions, new continents, new worlds, and new systems, are realizable for ever. The study of nature's mechanisms, of God's own applications of the same principles and materials, He has given inventors to work with, is only a beginning. The UNIVERSE is before inventors, and all its elements and energies invite their attention. There is, therefore, no danger in expecting or attempting, too much, provided they aspire not beyond where Nature herself has gone; and even then illusions vanish with experiment.

There is a good moral to be drawn by daring inventors from this fathomless and boundless ocean of novelties; it is this:— Avoid crowds of small craft in quest of improvements, and launch out your barks in search of original things. True genius is rather ambitious to bring up pearls of its own, than solicitous to polish those of other men. Since there is such abundance of room for all, it should be the determination of every one to occupy some ground of his own—to use another figure, to seek "*placers*" untouched, in preference to sifting in old diggings.—*Commissioner Ewbank.*

DIGNITY OF MECHANICAL PURSUITS.

It is a singular vagary that men to whose genius and industry the world is indebted for what is most valuable in it, should have always been held in low esteem. A habit of modern, it was a passion in former, times to look askant at those who use the hammer or spade, under the fond delusion that the less wise men have to do with gross matter, the nearer they resemble the Great Spirit; whereas God is the greatest of workers—the chief of artificers. So far from locking up his wisdom in abstractions, he is incessantly embodying it in tangible things; and in them it is that his intelligence, ingenuity, and resource are made manifest. What is this world but one of his workshops, and the universe but a collection of his inventions? In him the squeamishness of half-formed philosophers and of high-bred fashionables respecting manual and mechanical pursuits finds no sympathy, but terrible rebuke. His works proclaim his preference for the material and useful to the merely imaginative; and in truth it is in such that the truly beautiful or sublime is to be found. A steamer is a mightier epic than the "Iliad;" and Whittemore, Jacquard, and Blanchard, might laugh even Virgil, and Milton, and Tasso to scorn.

There is, moreover, a morality belonging to the arts that as yet has been little heeded; a lever, hammer, pulley, wedge, and screw, are actual representations of great natural truths; and the men who revealed them may be said to have been inspired. The Divine afflatus flows through many channels. In fact all truths are allied—the decalogue being an exponent of moral, as are mechanical inventions of physical, and axioms in science of philosophical verities; hence, whatever science discovers and art applies is Divine, and ultimately tends to eradicate evil: indeed, all teachings begin with the arts, and nothing is more certain than that all must end with them. If we glance at existing nations, we invariably find those that excel in arts and sciences most deeply imbued with moral principles—the foremost and most active in the benevolent enterprizes of the age.

Inventors, then, are revealers and expounders of the practical doctrines of civilization, and more than any other class have they shown us how to lessen life's evils and multiply its good. The connection of morals with expanding science and art, and the necessity of their union to the elevation of the species, are beginning to elicit attention. It is now perceived that deviations from principles of science—either in agriculture, arts, manufactures, in processes or pursuits of any kind—are errors; and all errors, in an extended sense, are SINS—are violations of Divine laws. And though sins of ignorance they carry, and will for ever carry, their punishment with them; viz., in imperfect results and the infliction of unnecessary inconveniences, expenses, and toil, in spending strength for naught.

Not till mechanical as well as ethical science is fully explored and universally applied can man attain his destiny, and evil be swept from the earth.

It has been regretted also, as an evil of magnitude, that, while the arts administer to the necessities of the species, a general knowledge of them has not been demanded as a feature of popular education; that while the works of historians, poets, and theorists have been adopted as models by which to form the taste and excite the ambition of youth, the great doctrines of life, as exemplified in the processes by which the products of the planet, its forces, and the properties of its substances are converted into the elements and accessories of material, and consequently of mental refinement, have been neglected.

But such are errors belonging rather to the past than the present or future. Their detection is a presage of their disappearance. Evils incident to the progress of society they, with many others, are only gradually to be surmounted. The philosophy or phy-

sics of the workshop is but beginning to be understood,—true estimates of its value to be formed;—indubitable proofs, however, that the movements of civilization are onward and upward. It is now perceived that, in ordinary avocations, principles of science are invoked that furnish subjects of research to the profoundest minds, and such as may serve to quicken and enrich the perceptions of the most inquisitive.—*Ibid.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING APRIL 3, 1851.

HENRY HOULDSWORTH, of Cottage-house, Lanark, ironmaster. *For improvements in the manufacture of iron and other metals.* Patent dated September 26, 1850.

The improvements here claimed are—

1. The application of the inflammable gases evolved from blast furnaces in the process of smelting to the roasting or calcination of iron, stone, and other ores of metal and lime.

2. The system of roasting or calcining minerals by such gases conducted through pipes or flues to close kilns or deposits of the minerals, and ignited therein.

3. The application of these gases to the purpose of drying cores or moulds, or other similar apparatus employed in the casting of metals.

4. The system of blowing smelting or melting furnaces, or fires employed in the manufacture of metals, by means of air blasts diffused over a large surface of the mineral under operation, either by two or more currents of air impinging one against the other, or by a current of air impinging against a fixed deflecting surface.

5. The employment of annular tuyeres or blowpipes for the purpose of diffusing the air blast.

CHARLES HARRATT, of Royal Exchange-buildings, merchant. *For improvements in rolling iron.* Patent dated September 28, 1850.

This invention consists in making piles or fagots of iron for rolling into bars or plates for railway and other purposes, by coiling a rod or bar round a bundle of rods or bars, so as to lay the grain in different directions, and cause the fibres to be well interlaced.

The patentee observes, that he is aware that iron has been previously twisted in a somewhat similar manner for making the barrels of fire-arms; he claims, therefore, the manufacture of iron by rolling rods or bars piled or fagotted as above described.

JOSEPH CROSSLEY, carpet manufacturer, and GEORGE COLLIER, mechanic, of Halifax, and JAMES HUDSON, of Littleborough, printer. *For improvements in printing yarns for, and in weaving carpets and other fabrics.* Patent dated September 28, 1850.

1. The improvements claimed "in printing yarns" comprehend a method of maintaining the yarns to be printed at a uniform degree of tension throughout their length during the operation of printing; of stopping the winding roller in the event of the breakage of a yarn; of stopping the roller when a sufficient quantity of yarn has been wound on, and at the same time giving notice to the attendant; of regulating the motion of the colour-box in the machine, and constructing the same and the apparatus in connection therewith.

2. The improvements in "weaving" have relation to looms arranged for opening two sheds, so as to admit of the weft and the wire passing through at the same time, and consist in a peculiar method of working the wires.

JAMES HAMILTON, of London, engineer. *For improvements in machinery for sawing, boring, and cutting wood.* Patent dated September 28, 1850.

Mr. Hamilton describes and claims—

1. A combination of machinery applicable chiefly to sawing the head and other staves of casks. In this machine two blocks of wood are shown at the same time under the operation of a suitable number of saws, which are mounted in two saw-gates, those in the front gate entering the wood about two inches in advance of those in the back gate, and then diverging to the right to form one side of the stave; the saws in the back gate following the others in the same straight cut, and then diverging at the same point in the opposite direction to form the other side of the stave, and finally leaving the block in the same cut as those in the front gate. The machine is provided with templates, to guide the saws in cutting staves of the required shape. The number of saws may be varied, and, if desired, they may be made to enter and leave the wood simultaneously.

2. A combination of machinery for performing the operations technically called "backing and hollowing" staves. This is effected by rotating concave and convex adzes or cutters.

3. A combination of machinery for boring the dowel-holes in the staves of casks. The principal features of this machine are the setting the drills so as to be adjustable with regard to each other, and mounting them in a frame which may be set at an angle if required.

4. A combination of machinery for giving staves the requisite shape and bevel. The circular saw, by which this is effected, is hung in the usual way, and the stave is placed on the bench at the required angle to

give it the necessary bevel, and guided by hand to obtain the proper shape.

5. A combination of machinery for forming "dowels" for casks. In this machine two cutters are employed, one to cut off a piece of wood of the requisite size, the other a circular hollow tool to finish the dowel. The first cutter is placed at a higher level than the finisher, and the severed piece of wood slides down an incline, and is forced against the second cutter by the continuous action of the machine.

WHITING HAYDEN, of Windham, Connecticut. *For an improved regulator or apparatus for regulating the draught of the sliver on the machine termed the drawing frame.* Patent dated October 10, 1850.

This invention consists in the application of a certain apparatus to the drawing frame, by means of which the speed of the rollers which accomplish the draught upon the sliver of cotton is regulated by the size of the sliver itself, thus causing the work of the machine to be uniform and perfect, and the apparatus by which this is effected to bo "self-acting." The regulating apparatus consists mainly of a trumpet-shaped tube capable of oscillating slowly, and applied to the drawing frame between the drawing and delivering rollers. The tube is of sufficient size internally to permit of the passage of the sliver, and at the same time small enough to be affected in its position by an undue increase or decrease in the size of the sliver. The tube is carried by a lever which at its lower extremity has an arm almost at right angles to it, in the direction of the back of the frame, which arm carries a counterweight. The lever is connected by a toggle-joint to a small pinion capable of gearing into either of two toothed wheels, communicating respectively by a train of wheels, with apparatuses for shifting the driving bands on the conical axles of the drawing rollers. The action of the apparatus is as follows:—Supposing the sliver in its passage through the trumpet tube to have become too large, the tube will be drawn forwards by the sliver towards the delivering rollers, and the pinion before mentioned will be caused to gear into the toothed wheel communicating with the back drawing rollers, the speed of which will be reduced by the shifting of their driving band on the conical axle. The speed of the front drawing rollers continues unchanged, and they consequently produce a greater draught upon the sliver, and reduce it in size till the trumpet tube is relieved and returned to its proper position by the action of the counterbalance weight on the arm of the tube lever. When the sliver becomes too much reduced in size, the above operation is reversed by the tube falling in the backward direction, and bringing the pinion into gear with the train of mechanism communicating with the front drawing roller driving belts, the speed of which will be reduced, while that of the others continues unchanged. When the sliver is at its proper size it passes freely through the trumpet tube and the pinion plays between the toothed wheels, but interferes with neither of them.

Claim.—The combination of the trumpet tube and the elements in connection therewith, or their mechanical equivalents, for changing and regulating the speed of the rolls and equalizing the drawing, or the making the sliver the required size, substantially in the manner before described.

JOSEPH BURCH, of Craig Works, Chester, printer. *For improvements in printing terry and pile carpets, woollen, silk, and other materials.* Patent dated September 28, 1850.

The improvements claimed by Mr. Burch comprehend

1. An arrangement of apparatus for cutting out figures on the surfaces of printing rollers. The cutter or drill is mounted in the same frame as a pointer, which is placed over a pattern corresponding with that to be cut on the roller. The pointer is traversed over the surface of the pattern, and the cuts are made when the drill is in its corresponding relative position.

2. A method of printing rugs and piled fabrics, so as to dispense with the colour furnisher. The colours are placed in a separate compartment of a longitudinal trough, which slides in guides underneath the printing table. Each compartment has a block for printing that particular colour; and the printing is effected by raising the block against the fabric whilst under the table. As soon as all the colours have been printed the fabric is removed to be dried.

3. A method of printing entire patterns in any variety of shade and colour, at one operation, by the employment of vertical slides to apply the colour.

4. A method of printing piled rugs, &c., in which the whole of the pattern is applied at one operation. In this method of printing a table is provided to receive the colours, and a thin ledge applied all round and between the colours, to prevent their mixing. The rug is then laid on the table, has pressure applied at the back, and is allowed to remain until all the colour is absorbed, when it is removed to dry.

5. A method of obtaining the high lights and shades on printed fabrics. This is done by the employment of a roller, which has its surface engraved so as to lay on colour where required. The shade is reduced in some cases by mere pressure while the fabric is still wet.

6. A method of bending type-metal printing surface around rollers, in which a plate of steel is interposed between the socket and plate to be bent, to prevent friction, and consequent injury to the surface plate.

AMENDMENT OF THE PATENT LAWS.—LORD BROUGHAM'S BILL.

Lord Brougham has brought in a Bill for "An Act further to Amend the Law touching Letters Patent for Inventions." The principal improvements which it proposes to effect are three in number:—

First.—One patent to be substituted for all the three kingdoms, instead of one for each, as at present; the patent to comprehend also "the Town of Berwick-upon-Tweed, the Channel Islands and Isle of Man, and all the Colonies and Possessions abroad."

Second.—The Patent to run from the date of the application. And

Third.—There is to be paid, in the first instance, in fees, 20*l.*, and a stamp duty, 10*l.*=30*l.*; at the end of three years, a stamp duty of 40*l.* 5*s.* additional; and at the end of seven years, a further stamp duty of 70*l.* 5s.—making in all 140*l.* 10*s.*

The Bill further proposes to appoint the Lord Chancellor and certain other law functionaries to be "Commissioners of Patents for Inventions," who shall be invested with power to "make such rules and orders respecting applications for and the making and issuing of Letters Patent, and other matters and things in anywise touching and concerning the premises *as may be necessary, and are not herein provided for.*"

We do not like the delegation of so much power to the proposed Commissioners, and consider there is room for a much larger measure of reform than this Bill provides for; but as it is, it meets satisfactorily some of the worst evils of the existing state of things, and we therefore cordially wish it all success.

RAWSON'S TREATISE ON "THE SCREW PROPELLER."

We have not for a long time felt more sincere pleasure than we did on perusing the *Artizan* for this month, at finding that Mr. Rawson has taken in good part our animadversions on his book on the "Screw Propeller," and that he is literally adopting our advice by publishing, in that Journal, what may be called a new edition of his Work, free from most of the material errors that led to false conclusions in his publication. Among other things, we are sincerely glad to notice the disappearance of the moment of inertia from all the results. This is as it ought to be. We rejoice also to find that he has adopted and reproduced, by a somewhat different method, the investigations which we presented to his notice, with respect to the relations which exist between the moment of the engine and what he calls the statical surface pressure, and between the same moment and the horse power of the engine. We must except from this praise his attempt to reconcile his *new* with his *old* results, which, of course, could not but be a failure. On this, however, we will not dilate. We think that the mechanical world will participate in the pleasure we feel at having found so apt a pupil in Mr. Rawson, and rejoice, with us, that our labours have not been bestowed in vain.

WEEKLY LIST OF NEW ENGLISH PATENTS.

John Gwynne, of Lansdowne-lodge, Notting-hill, Middlesex, merchant, for improvements in machinery for pumping, forcing, and exhausting of steam, fluids, and gases, and in the adaptation thereof to producing motion to the saturation, separation, and decomposition of substances. (Being a communication.) March 31; six months.

John Peter Booth, of Cork, Ireland, feather purifier, for an improved manufacture of fabric applicable to the construction of muffs, boas, tippets, and other like articles, and also to the ornamenting of articles of dress and furniture, and other similar uses. March 31; six months.

Louis Brunier, of Paris, civil engineer, for improvements in obtaining power by the use of steam or compressed air. March 31; six months.

Joseph Richardson, of Halifax, York, dyer, for improvements in dyeing and cleansing piece goods March 31; six months.

Auguste Motte, of Southwark, Surrey, manufacturer, for certain improvements in portmanteaus. April 2; six months.

Thomas Huckvale, of Choice Hill, Oxford, for improvements in treating mangle-wurtzel, and in making drinks and other preparations therefrom. April 2; six months.

Richard Archibald Brooman, of the firm of Messrs. J. C. Robertson and Co., of Fleet street, London, patent agents, for improvements in machinery for the manufacture of rope and cordage. (Being a communication.) April 2; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
Mar. 27	2745	Perkins and Sharpus	Bell-court, Cannon-street	Double cone smoke elevator for curing smoky chimnies.
„	2746	G. R. Woolgar	Wood-street, Cheapside	La jumelle scarf cravat.
28	2747	Edward Shingler	Birmingham	Sporting boot
„	2748	Garton and Jarvis	High-street, Exeter	Convolute boiler for heating hot-houses, conservatories, public and other buildings, by steam or hot-water circulating through pipes.
„	2749	Blackwood and Co.	Long-Acre	Ready reference file.
29	2750	L. Silberberg	Fleet-street, and St. Martin's-Le-Grand	Askopsolon cigar-case.
„	2751	George Ellwood	Aldersgate-street	Expanding fur cuff.
31	2752	Stock and Son	Birmingham	Tap.
„	2753	Tylor and Sons	Warwick-lane, Newgate-street	Bath.
„	2754	George Dible Beckett	Fenchurch-street, and Grace-church-street	Boot.
April 1	2755	Richard Milliard	Craven-street, Strand	Portmanteau bag.
„	2756	D. Hulett	High Holborn	Compound concentric gas burner.
2	2757	Alfred Richard Corpe	King-street, St. James'	Fastening for trowser-straps.
„	2758	Peter R. Jackson	Salford	Safety cap for steam boilers.
„	2759	Isham Baggs and James Wm. Giles	Aldersgate-street	Fire and burglary alarm.
„	2760	Robert Plummer	Newcastle-on-Tyne	Flax straw-breaking machine.
„	2761	J. Coate and Co.	Brewer-street, Golden-square	Anti-carious tooth brush.
3	2762	Joseph Haley	Manchester	Safety signal for steam boilers
„	2763	Haxley, Heriot, and Co.	Castle-street, Long-Acre	Iris reading and copying press

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Mar. 27	118	Gregory Kane	Dublin	Portmanteau buckle.
28	119	Thomas Allen	Clifton	Iron roof.
„	120	Richard Wesson	Coburg-street, Hampstead-road.	Secret lock.
29	121	Etienne de Maignol Mataplane	South-street, Finsbury	Circular tilting platform.
„	122	Edward Golding	Hurstbourne Priors, Andover-road	Rolling barley chumper.
31	123	Michel Roch	South-street, Finsbury	Letter envelope.
„	124	John Freeman	Wigmore-street	Napoleon cafetière.
„	125	Edward Hughes	Stockbridge-terrace, Pimlico	Self-adjusting lamp.
April 1	126	Nosophore Rabiot	South-street, Finsbury	Invalid bedstead.
2	127	Michel Roch	South-street, Finsbury	Letter envelope.
„	128	John L. Fry	Honiton	Tailor's cardinal point, measure, and rule.
„	129	Giles Little and Co.	Fetter-lane and Cursitor-street.	Ring for fishing-rods and other purposes.
„	130	Samuel Jackson	Red Lion-street	Illuminated candle clock.

Erratum.—Page 223, col. 1, line 4, for (by the water) read (*by the vessel*). Page 224, col. 1, line 16, for "$n=\frac{10}{15}(10-2)=54'4$." read "$n=\frac{102}{15}(10-2)=54\cdot4$."

CONTENTS OF THIS NUMBER.

Description of Plummer's Registered Patent Flax-breaking Machine—(*with engravings*)... 261
Naval Architecture—Dr. Woolley's New Method of finding the Displacement ... 262
Mr. J. Scott Russell's Wave-line Theory ... 268
Gleanings from the Unpublished MSS. of the late Brigadier-General Sir Samuel Bentham: Suspension Railways—Fishing Nets—Mallets—Masts—Fresh Water at Sea ... 268, 270
Description of Messrs. Garton and Jarvis's Registered Convolute Boiler—(*with engravings*) 270
Description of Messrs. Perkins and Sharpus's Registered Copper Pots, &c.—(*with engravings*) ... 271
Hints on the Economy of Cookery ... 271
Photography in Natural Colours ... 273
Mr. Frost's "Stame."—Reply of Mr. Cheverton to "An Impartial Observer" ... 275
Discoveries and Improvements Endless. By Commissioner Ewbank ... 275
Dignity of Mechanical Pursuits. By the same 276
Specifications of English Patents Enrolled during the Week:—
Holdsworth ... Metal Manufactures.. 277
Harratt ... Rolling Iron ... 277
Crossley & Hudson ... Carpets ... 277
Hamilton ... Cask Machinery ... 277
Hayden ... Drawing-frames ... 278
Burch ... Printing Piled Fabrics ... 278
Reform of the Patent Laws—Lord Brougham's Bill ... 279
Rawson's Treatise on "The Screw-Propeller" ... 279
Weekly List of New English Patents ... 279
Weekly List of Designs for Articles of Utility Registered ... 280
Weekly List of Provisional Registrations ... 280

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Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. BOGGETT AND SMITH'S PATENT ROTARY ENGINE.

Fig. 6.

Fig. 2.

MESSRS. BOGGETT AND SMITH'S PATENT ROTARY ENGINE.

(Patent dated October 3, 1850. Specification enrolled April 3, 1851.)

FIG. 1 is a longitudinal section, and fig. 2 a cross-section of this engine. A is a cylinder which is mounted on a central shaft E; this cylinder is closed at its two ends by flanged plates BB, to which are attached two stuffing-boxes CC, through which the shaft is passed. DD are glands for tightening the packing of the stuffing-boxes; I is a cylindrical ring of considerably smaller diameter than the cylinder A, which moves eccentrically within it in a manner to be presently explained. J is a guide-arm or leaf, which projects from the ring I, and works to and fro (as the ring describes its eccentric movements) in a recess M on one side of the cylinder A. F is a steam stop-blade which projects from the central shaft E, and is inclosed in the ring I, with the interior surface of which it is kept in close contact by means of a packing W. GG are two flanged plates which are attached to the stop-blade F, and are inclosed within the ring I, one on each side. N is a port by which steam is admitted into the main cylinder A. L a passage in the end of the guide-arm J, by which the used steam passes off into the eduction port T. P, Q, R (fig. 1), passages on one side of the ring I and arm J, by which a portion of steam is conveyed from the main cylinder A, and through the central shaft into the interior of the eccentric ring I; and T V passages on the opposite side of the arm J, by which the steam may flow freely out again from the eccentric ring I, as occasion may require. The action of the engine is as follows: The steam being admitted through the induction port N into the cylinder A, on one side of the arm J (say into the space O, as represented in fig. 2) presses on that side against the exterior of the eccentric ring I, and carries it round along with the shaft E and steam stop F, in the direction of the arrows, pressing the eccentric ring at the same time into close contact at the farthest opposite point with the inner face of the cylinder A.

The rotary movement thus imparted to the eccentric cylinder and shaft continues till they have completed one revolution, and the other end of the stop F comes opposite the eduction port T, when, on the slightest further angular movement, the used steam escapes through the passage L to the port T, and room is made for a fresh supply through the induction pipe N, to produce another like revolution of the shaft; and so on continuously. The only dead point which occurs in each revolution is while the steam-stop F is passing the recess M, but the effect of this is in a great measure, if not entirely counteracted by the steam, which is constantly flowing into, and from the interior of the ring I, through the passages P, Q, R, and T, V. A small fly-wheel may be added to equalize still more effectively the action of the engine.

Figs. 3, 4, 5, and 6 are separate representations of different parts of this engine. Fig. 3 is a side elevation of the central shaft E, with its steam stop-blade F; fig. 4 is a section on the line AB of fig. 3, showing the blade packing W and steam passage R; fig. 5 an end elevation; and fig. 6 a part elevation of the cylinder I and guide arm J.

A method of packing the guide arm J, which may be adopted instead of that shown in figs. 5 and 6, is represented in fig. 7 (cross section), and fig. 8 (plan). B is a block in which the arm terminates; A a passage cut out of one side of the block for the escape of the steam; and *d* metallic packing on the opposite side, which works against the inside of the recess M.

Or, instead of either of the modes before described of packing the guide arm F, the following may be substituted:—Between the flange plates GG and the inside of the ring I there may be introduced, as represented in fig. 9 (an end elevation) and fig. 10 (a front elevation), a conical ring *a* (either split or not), provided with a feather *b* to take into a groove in the cylindrical ring. This feather will prevent the conical ring from turning round on the end plates GG, and yet allow of its being pressed up tight into its place by means of screws *c*, *c*, *c*, whose heads are countersunk in the ring, and reached (when required to be turned) by means of a key passed through corresponding holes in the end cover B of the cylinder A, which holes are at other times kept closed by screw plugs or caps.

Fig. 3.

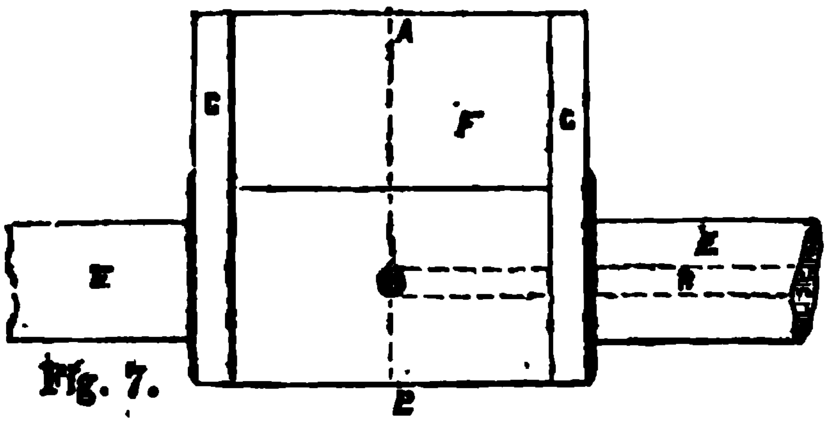


Fig. 7.

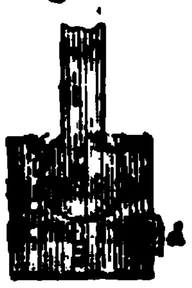
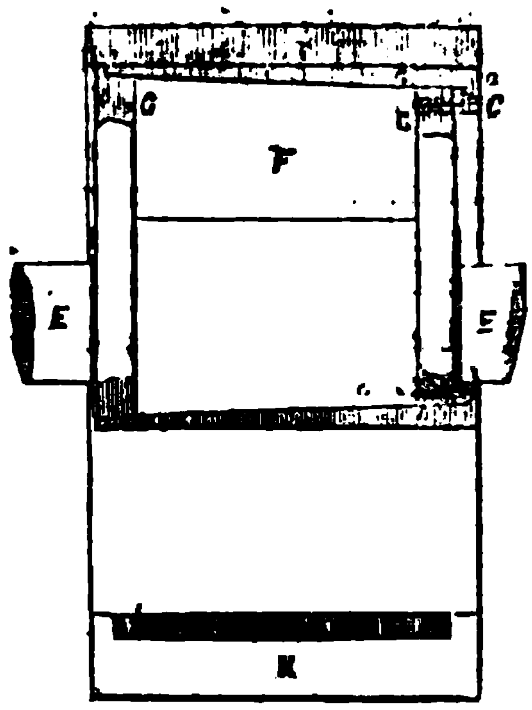


Fig. 10.



To reverse an engine of this description, all that is necessary is to use the induction as eduction passages, and *vice versâ*.

It may be worked, too, either as a low or high-pressure engine, or as a high-pressure, expansive, and condensing one.

And it may also be readily adapted to use as a pump for raising or forcing water, or exhausting and condensing air.

Claims.

First. We claim the peculiar arrangement and combination of the parts of which the rotary engine before described consists; that is to say, the combination of a cylinder and cylindrical ring, one working eccentrically within the other, the latter carrying round with it the working shaft and steam stop-blade or piston; and both the cylinder and ring being open to the ingress and egress of steam, as before explained and described.

Second. We claim the mode of constructing the guide arm J before described, whether the same is employed as part of the peculiar combination aforesaid, or as part of any other combination of parts for rotary engine purposes. And

Third. We claim the application of the said engine to pumps for raising and forcing water, and exhausting and condensing air.

ON TWO INDETERMINATE THEOREMS. BY T. T. WILKINSON, ESQ., F.R.A.S.

On referring to the article on "The Miscellanea Scientifica Curiosa," in the *Mechanics' Magazine*, vol. lii., pp. 226-270, it will be found that two *indeterminate theorems* are there noticed; one of which is demonstrated, and the other left unsolved, in consequence of the discontinuance of the periodical. A short time previously to the appearance of the paper referred to, I had occasion to furnish the late lamented Professor Davies with the enunciations of these theorems, which he desired for a particular purpose, and he subsequently communicated the following demonstrations, with a request that they should be sent to this Journal as soon as he had "time to write out the porisms to which they [had] led [him], *in form*." The hand of death, however, arrested his progress, and he was removed from this sphere of usefulness to a better, before he had fulfilled his intentions. Under these circumstances I have judged it best to give the proofs as originally written, and have added one or two inferences and remarks which may possibly not be without their use.

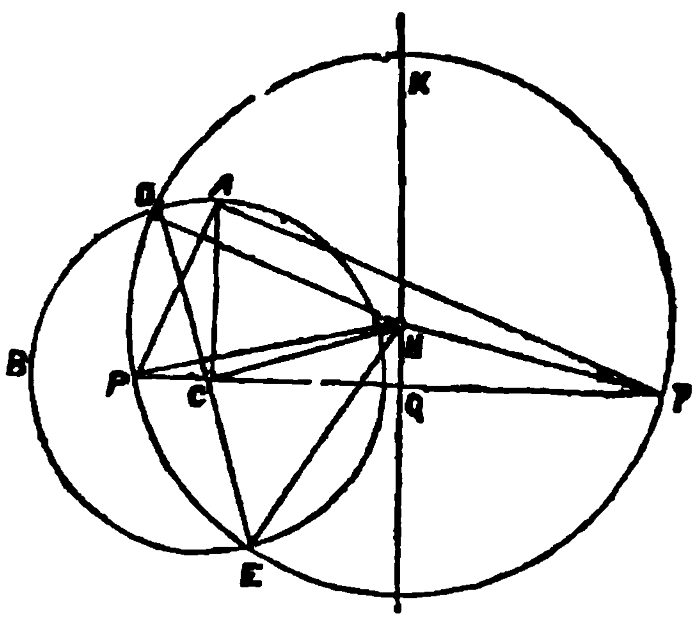
Question 28, *M.S. Curiosa.*

"If PAp be a triangle, right-angled

at A; AC perpendicular to Pp; AEBD a circle whose centre is C and radius CA; and if KL bisect Pp at right angles:—I say that a circle PDEI, whose centre is any point H in the indefinite line KL, described through one of the points P or p, shall likewise pass through the other and intersect the periphery of the former circle in opposite points D, E:—a geometrical demonstration is required."

I. *Demonstration by the late Professor Davies.*

Fig. 1.



"Join DC, CE, DH, HE, PH, Hp; and let Q be the intersection of Pp and KL (fig. 1). Then $HD^2 - HC^2 = HP^2 - HC^2 = QP^2 - QC^2 = (QP + QC).(QP - QC) = PC.\,Cp = AC^2 = CD^2$. Whence HCD is a right angle.

Again; $HE^2 - HC^2 = Hp^2 - HC^2 = pQ^2 - QC^2 = QP^2 - QC^2 = PC.Cp = AC^2 = CE^2$.

Whence HCE is a right angle.

∴ D, C, E, are in a right line, or the circle DAEB is bisected by (H)." Q. E. D.

II. *Demonstration by* "Pappus, *junior*," *probably the Rev. W. Crackelt, Editor of the work.*

"Now $PC.pC = DC.CE$. Also $PC : DC = AC :: DC : pC$. ∴ $DC^2 = PC.pC$, and consequently $DC^2 = DC.CE$, that is $DC = EC$, whence DE is the diameter of the circle AEBD, and in consequence thereof, E is the other point of intersection." Q. E. D.

With regard to these and similar inquiries, Mr. Davies remarked that "generally, wherever in the solution of a *problem* we find an *indeterminate case*, *there is a porism*..... several of which were known in particular instances long before Simson recovered their *theory*... Let n conditions be both necessary and sufficient for limiting a problem and finding the p quæsita of it. Then if the data be so related, that $n-1$ of the conditions *imply* the nth condition, the problem is indeterminate; and the allegation of this dependence upon the $n-1$ data of the nth itself is the enunciation of the porism, whilst the finding actually this nth (otherwise) datum constitutes the solution of it....The most usual form in which a *problem* becomes indeterminate is when $n-1$ data imply a point to be found *in the course of construction*, turning out to be in the particular case identical in position with the nth datum ... But it is not in the solution of geometrical problems only that this principle is applicable. In algebra *it is precisely the same.* Indeed, the whole of our investigations of developments in series or otherwise—our indeterminate co-efficients—Lagrange's indeterminate multipliers, and other matters of this class, turn upon the same principles. In fact the principle ranges universally, and under numberless different forms ... It has been generally assumed that the converses of porisms are porisms or loci. They are more frequently indeterminate theorems than either. But even this is to be understood with reservation; for the word *converse* is slightly varied from its usual strict meaning. A more definite statement will be:—make a hypothesis of the entity which the porisms affirms to be *given* (may be found); and it is converted into an indeterminate theorem; and the converse (strictly converse) of this is either a theorem stated indeterminately or a locus properly stated.....Even *determinate* problems (or theorems even) when the solution requires that some point shall be passed, or circle touched by the final entity (quæsitum or hypothesis) will in five cases out of six give a porism. *Envelopes* ALWAYS involve a porism amongst their family connections, and very often, too, do *projective properties;* though I am not prepared to say '*always*' in this case, without restricting the term *converse*, and some others more carefully than is usual.... In indeterminate theorems (the statement not being a locus), there is stated to exist a common property *belonging to things*

dependent on a locus, or on a point, or on something specified:—In a porism it is affirmed that certain things being given, others can be found such that this property shall exist. They have precisely the same kind of relation that a local theorem and a local problem have to each other. When the *something* to be found *has been found*, the porism becomes an indeterminate theorem, and its demonstration is simply that of the indeterminate theorem. The very same as in ordinary determinate propositions, the construction being given, the problem including this is converted into a theorem and *demonstrated as such*." Mr. Potts in his able sketch of the "Ancient Geometrical Analysis" (Euclid, p. 292), has also observed that "every indeterminate problem containing a locus may be made to assume the form of a porism, but not the converse:" hence bearing in mind the preceding observations, we may give the following porismatical form to the proposition from the *Miscellanea*, which, however, as will be seen, is not the most elegant form, it may be made to assume.

Porism.—A point may be found in the hypothenuse of a given right-angled triangle, from which, if a circle be described whose radius is also to be found; it will have its circumference bisected by any circle passing through the acute angles, and having its centre at any point whatever in a line whose position is also to be determined.

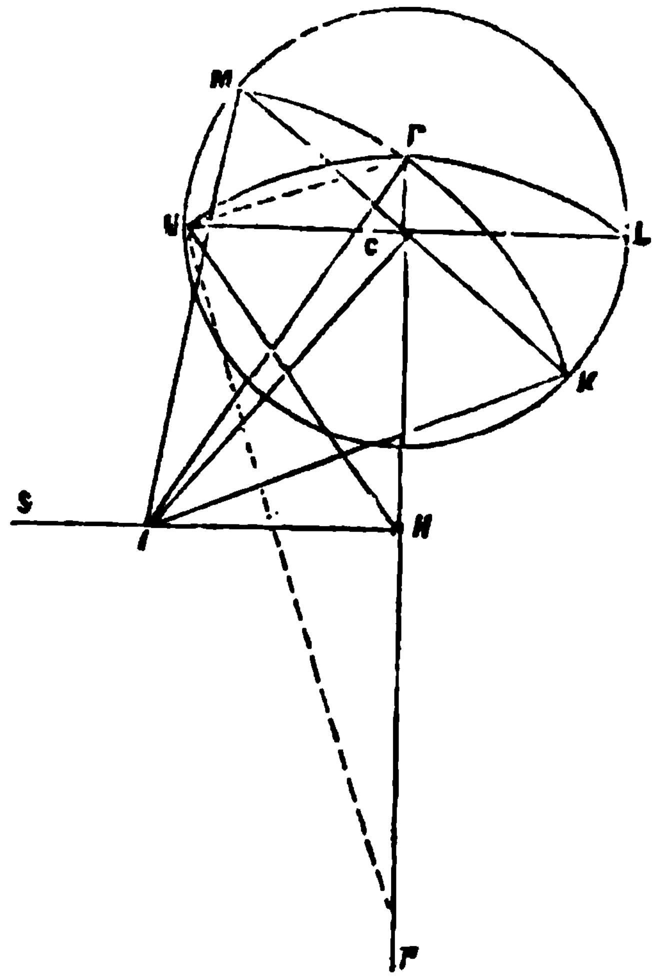
Remark.—The point to be found is obviously the intersection of the perpendicular with the hypothenuse—the radius of the circle to be found is the perpendicular itself—and the line given in position bisects the hypothenuse perpendicularly. Whence the demonstrations of the porism are obviously the same as those for the indeterminate theorem.

Ques. 67. *M. S. Curiosa.*

"C is the centre of a given circle, and P a point in that circle; join the points P, C, and produce PC indefinitely:—draw NCL at right angles to PC, and finding the centre H of a circle that will pass through the points N, P, L, erect the indefinite perpendicular HS:—in this perpendicular assume any point I, and from thence as centre with IP radius, describe an arc of a circle MPK, and it will cut the circle NMLK in opposite points. Required the demonstration."

1. *Demonstration by the late Professor Davies.*

Fig. 2.



"Join MC, CK, JM, JC, JK, and NH. Then $HC^2=HP^2-NC^2$, since $HP=HN$. Also $IC^2=IH^2+HC^2=IH^2+HP^2-NC^2=IP^2-NC^2$.

$\therefore IP^2=IC^2+NC^2=IC^2+CM^2=IM^2$, and hence MCI is a right angle. *Euc.* i. 48.

Again; $HC^2=HP^2-LC^2$, since $HP=HL$. Also, $IC^2=IH^2+HC^2=IH^2+HP^2-LC^2=IK^2-LC^2=IK^2-CK^2$.

$\therefore IK^2=IC^2+CK^2$, and hence ICK is a right angle. (*Ibid.*) $\therefore$ M, C, K, are in one line, in the circle (I) bisects the circle (C) in M and K." Q. E. D.

2. *Another Demonstration may be as follows, agreeing in form with that by "Pappus" to the previous question.*

From M, one of the points of intersection, draw the chord MCK through C to meet the circumference of the circle (I) in K; also make $Hp=HP$. Then $PC.Cp=MC.CK$. (*Euc.* iii. 35.)

But $PC : CN = CM :: CM : Cp$.

$\therefore PC.Cp=MC^2=MC.CK$. $\therefore MC=CK$.

Whence MK is the diameter of circle (C), and since K is consequently in *both* circles, it is the *other* point of intersection. Q. E. D.

Cor.—Since $HP=HN=Hp$, the angle

PNp is a right angle; and hence the *identity* of this question with the preceding one is at once apparent.

The local theorem answering to both questions may consequently be put under the following form:—a circle is given in magnitude and position, and also a point within it; the locus of the centres of all circles passing through the given point, and bisecting the circumference of the given circle, will be the right line HS bisecting Pp perpendicularly. Hence suppressing "that part of the hypothesis which contains the construction" agreeably to Professor Playfair's directions in Art. 17 of his "Origin and Investigation of Porisms," we obtain immediately the following porisms:—

1. A circle is given in magnitude and position, and also a point within it;—a right line may be found given in position, such, that if from any point whatever in this line, a circle be described passing through the given point, it will also bisect the circumference of the given circle.

2. A circle and a line are given in magnitude and position respectively; a point may be found such that any circle whatever being described having its centre in the given line, and passing through the point, it will also bisect the circumference of the given circle.

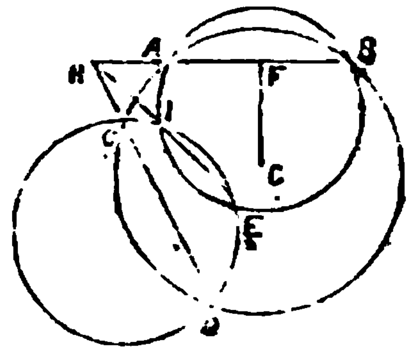
Remark. Join PC, and produce it indefinitely—through C draw the perpendicular diameter NL—a circle through NPL determines H, and the perpendicular HS will be the line required in (1), as is obvious from the preceding demonstrations;—(2) is merely a converse of (1).

Both the indeterminate theorems and the porisms deducible therefrom may be supposed to be derived from the following problem, which received solutions in the *Lady's Diary* for 1760—1, Ques. 469;—*Gentleman's Mathematical Companion*, No. xxix., p. 541;—and *Bland's Geometrical Problems*, vi. 49, Ed. 1827. The last-named solution is preferred on account of its ready adaptation.

Problem.—"Through two given points, to describe a circle, which shall cut off from a given circle an arc equal to a given arc."—*Solution, Bland*, p. 214.

"Let A and B be the given points, and CDE the given circle. Join AB; and bisect it in F; from F draw FG at right angles to AB; and from any point

Fig. 3.



G in it, at the distance GA or GB, describe a circle ABD, cutting the given circle in C and D. Join DC, and produce it to meet BA in H. From H draw HJE (*ii.* 20), so that JE may be equal to the chord of the given arc.

"Through A, B, E, describe a circle; it will also pass through J, and cut off the arc required.

"For the rectangle HJ. HE is equal to the rectangle HC. HD, and ∴ also to the rectangle HA. HB; whence J is a point in the circle ABE."

Remark. Now when A and B are in the same right line with the centre of the given circle, the point H coincides with this centre; JE also coincides with CD, and the circle ABEJ with ABDC; —but G is *any point whatever* in FG, and therefore *any* circle through A, B, will bisect the circumference of the given circle; whence the porisms, &c.

The same principles may be applied to the problem of describing a circle so as to bisect the circumferences of two or three given circles:—the former inquiry giving rise to the following porism noticed by Professor Davies.

"Two circles being given, there are also given two points and a straight line, such, that every circle whose centre is in the line, and which passes through the two points, will bisect the circumferences of the two given circles."

When three circles are concerned, a point in each circle may be determined through which the bisecting circle passes, which agrees with a construction given in the MS. remains of the late Mr. J. H. Swale:—its generalization includes the *Diary* Prize Question for the present year. Much important information on the subjects here noticed may be found in Gompertz's "Hints on Porisms," recently published; and no doubt the whole doctrine will be so fully illustrated and

explained as to bring it within the reach of the most ordinary student, when Mr. Potts receives sufficient encouragement to justify the publication of his projected translation of Dr. Simson's "Treatise on Porisms," with accompanying notes and dissertations.

THOS. WILKINSON.

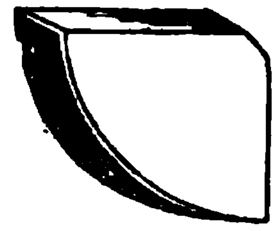
Burnley, Lancashire,
March 31, 1851.

SWING GATES.—THE KILMORY XX GATE.

Sir,—I was much interested in the notice contained in your Number of March 22nd, of an American patent gate, being an amateur performer in that line myself, as you may see by the inclosed paper containing a slight sketch and description of an invention of my own. The simplicity of the idea is itself a great recommendation, and if I suggest doubts and difficulties as likely to be met with in practice, it is not in order to throw cold water on it, but in hopes of contributing to its general use and improvement.

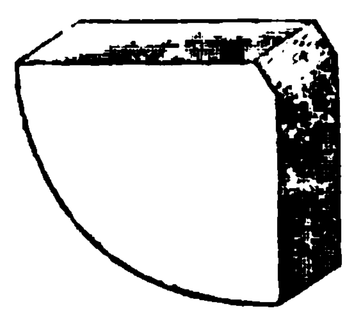
In case of having to shut a carriage-road, the weight of 9 or 10 feet in one piece would make this principle quite inadmissible, and a pair would be necessary (as represented in your woodcut.) This has always the objection of requiring two motions, and a change of place to open both leaves, whilst there is great risk of a carriage going on when one is open and catching the other. In this gate, as the leaf does not open in the plane of the said carriage's motion, a more perilous smash would ensue, than with an ordinary hinged gate. I obviate this with double doors, &c., by making them work together with a crank connection, like the railway horse-boxes, but do not see my way to apply this simply and effectually to your American turnover gates. The weak point which I see in them, is a want of strength when shut. The woodcut appears to show a rest in the middle of the road for each leaf to fall into, but three "stones of stumbling" are very objectionable in a gateway; besides which, there would be no dependence on their falling into it. A gate without mortices, &c., &c., is easily made to be sure, but is also easily unmade. At top there appears to be a kind of wooden draw bolt—this might prevent one passing another, but would not keep them together if pressed against. If one gate had hooks to fall into eyes on the other, or a hook-and-eye below, and above one had an iron loop to go over the top of the other end post, it would make them stronger.

Talking of mortices, to avoid these I have had cast-iron sockets made for gate

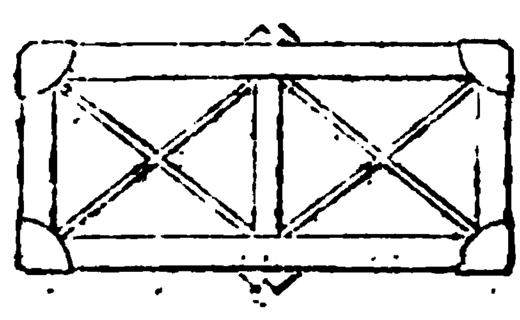


corners; the top, or bottom, and end being united together, are capped with these and diagonal wires being run through them, the gate is screwed up square and firm. I have had these in operation for many years, and the wood remains quite sound; and having been put in dry with white lead, fills the sockets so completely that it is a most difficult job to get one asunder when required.

The angles are taken off for about an inch, thus, affording a shoulder on



which to screw up the wires. The gates are made nearly, or quite two squares,

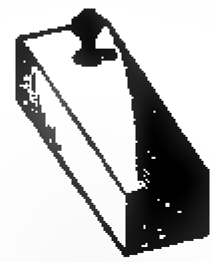


and in the centre of top and bottom a small casting is let a quarter of an inch into the wood, through which the wires are also

screwed. I have since made a great improvement by putting a centre block, spreading out wires a foot or 14 inches in the middle, which lead thence to the angles, and make the whole a "truss"

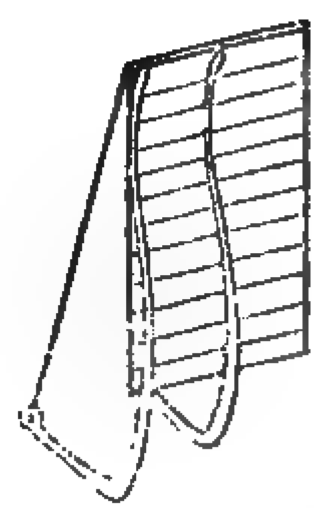
in every direction. I exhibited these at the Highland Society's Show in Edinburgh; and the principle has been adopted by a great iron-worker there (without acknowledgment, which is all I complain of), and may be seen on all the gates of the Scottish Central Railway.

But to return to your American turnovers, I would improve them thus: AB should be a sleeper, with pivots at the points A and; B the heel of the gate should be mortioed into this, and from C to B, and from D to B, should be wooden, or iron stays. One of these latter would be the only additional weight to lift, whilst the gate would be infinitely stronger, and require no post or fastenings. The pivots at A and B may work in two eyes let into a stone—the latter



may be sunk flush in the ground; or if cheapness be preferred, it would work well enough without pivots, and merely confined by four pegs driven into the ground.

It strikes me, however, that I have thought of a still better scheme, as sketched below, by which the gates will open and close with less labour, and shut or set back with less jar. I have this morning made a rough model, full size, and it acts well; and I shall at once set about a garden gate and a stable door. My principle is, I conceive, particularly well suited to doors, or to anything higher than it is wide, whilst the American plan must be almost confined to squares. The struts, EK, MN, are to be in pairs (those on the further side not being seen), I propose to make those on one side perpendicular, and their fellows on the other side angled, so as to give support from a wide base. Any of your readers who are curious about my former plan of gates will find a small model of one in the Polytechnic Institution. I did not send it there till I had well tried the real thing in practice, and I shall pursue the same course now. I subjoin



my name and address, in order to conform to your rule; but the public will probably be quite satisfied with the signature of RUSTICUS.

[The paper enclosed in our corre-

spondent's letter is a description of "the Kilmory XX Gate," which appears to have been exhibited at one of the Highland Society's Shows. As the description is not long, and it will serve to put our readers in possession of the entire subject, we here subjoin it.]—Ed. M.M.

THE KILMORY XX GATE. INVENTED BY SIR JOHN ORDE, AND CONSTRUCTED BY HIS OWN WORKMEN.

The principle of diagonal trussing, or bracing *in one perpendicular plane*, has been immemorially practised in gate-making; and most persons practically acquainted with their manufacture, will acknowledge that it is impossible to construct a permanently good gate without it.

Many, however, of the very best made in the ordinary manner, either from warping or twisting of the wood, or from the transverse strains to which they are exposed in ordinary use, in shutting and opening, and from the rubbing of stock, or their attempts to force them, soon become distorted, and, if not absolutely useless, at least very unsightly.

The inventor trusts that he has now succeeded in producing a gate with the least possible liability to change of form, whether from internal or external causes, and calculated to resist the *charge* of cattle to such an extent, that the posts, hinges, or bolts must be almost certain to yield before the gate itself.

These advantages are attained with very trifling amount of material, and no great demand for skilled workmanship.

The gate now exhibited is merely to show the principle of framing, to which almost any filling up may be adopted, from a net or piece of tarpauling to a sheet of iron or a row of strung pales strung on chain.

The rim of the gate is formed, in this example, of two No. 2 wires, drawn at each corner through an angle-plate, into which two rafters abut (one for each face of the gate). These rafters are made rather longer than half the diagonal of the gate, so that when those of one side are put together in the rim, laid flat, they rise in the middle like the hips of a pavilion roof.

In the gate exhibited this rise is 9½ inches—the gate being 9 feet 6 inches long and 4 feet 6 inches high. From the centre of one face to the centre of another is passed an iron bolt, the head of which catches the ends of the four rafters on one face, whilst a plate and screw-nut on the other end catches those of the opposite face. A few turns of the nut force up the whole and distend the rim—the whole acting something like a double umbrella.

This is the frame, showing a double truss in every direction.

For equally extending, the filling in, and keeping it tight and fair, the inventor has adopted the principle of suspension chains. The angles of the gate afford the fixed points, from which the main *chains* are allowed to assume Catenarian curves, so as to give equal strains at every point where the upper is connected to the under, or that of one end to that of the other, whether by a sheet, a net, or rods, or bars, or poles, or chains. In the case of rods, bars, or poles, as it is not necessary that they should be connected by their extreme ends, the filling up may extend to the rim, or project beyond it. With material only kept straight by tension, there is a small intervening space left open, as between the foot of a sail and its yard or boom.

The gate exhibited is lightly filled in with wire, to correspond in some sort with a strained wire fence, and weighs 66 pounds.

The hinge pivots and latch pins are worked on the angle-plates, and included in this weight.

The posts are the same as those exhibited by the inventor some years ago at Glasgow, and are used by him on almost all occasions, in preference to fixed posts, as admitting of more accurate adjustment, in the first instance, and easily rectified, should the sinking of the ground, or a *collision* or other accident require it; as less liable to decay than sunk posts, which soon go between wind and water; and because, in the event of a gate being needed in a hurry, ten minutes are sufficient to put up a pair of these posts anywhere.

The inventor has not sought to protect either of these designs, and would be only too happy to see them brought into general use, if they will stand the test of general, as they have done of private experience. He would only request of the public not to act by him in this case as in that of another design of his, also exhibited at the Highland Society's Show in Glasgow, and used by him for some time previous: viz., Trussed Single Trees, or Draught Bars,—which subsequently appeared in several places, and in at least half a dozen instances, at the late show in York, as *invented* by the exhibitors.

A B Main bolt.

A D, A G, Á C, Á E — The four rafters of farther face.

B D, B G, B C, B E — The four rafters of nearer face.

C D E G Rim composed of two wires.

C & E Hinge pivots.

D & G Latch pins.

MURRAY'S SELF-CLEANSING TUBULAR FILTER.

Fig. 1.

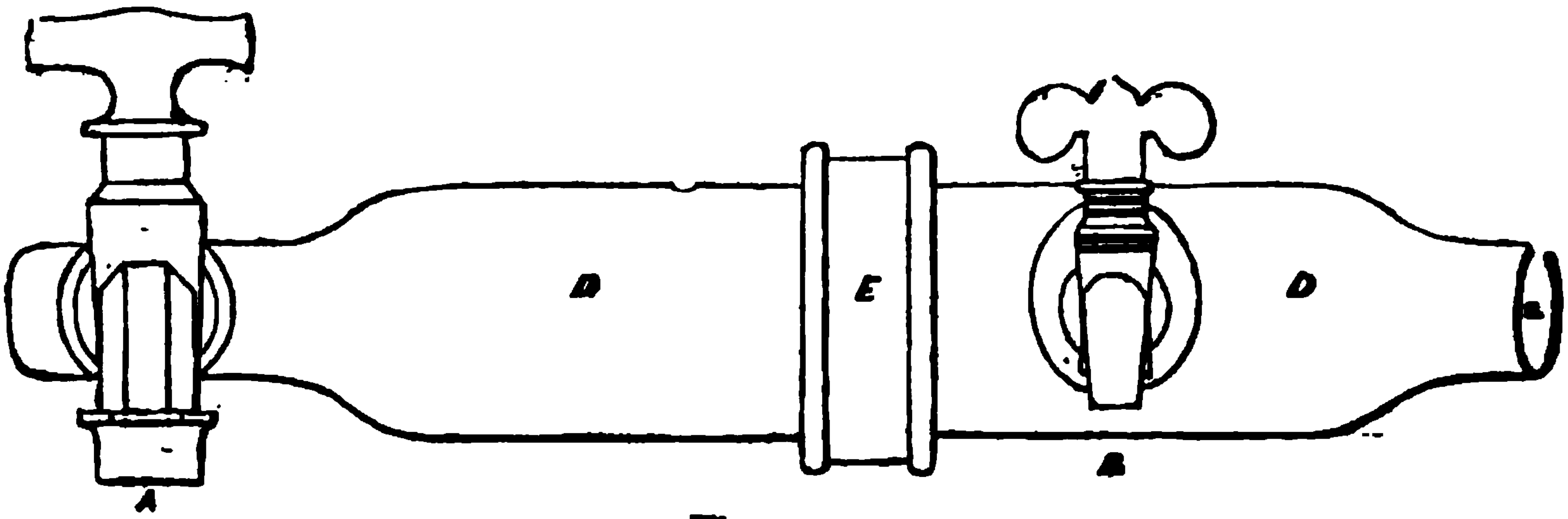
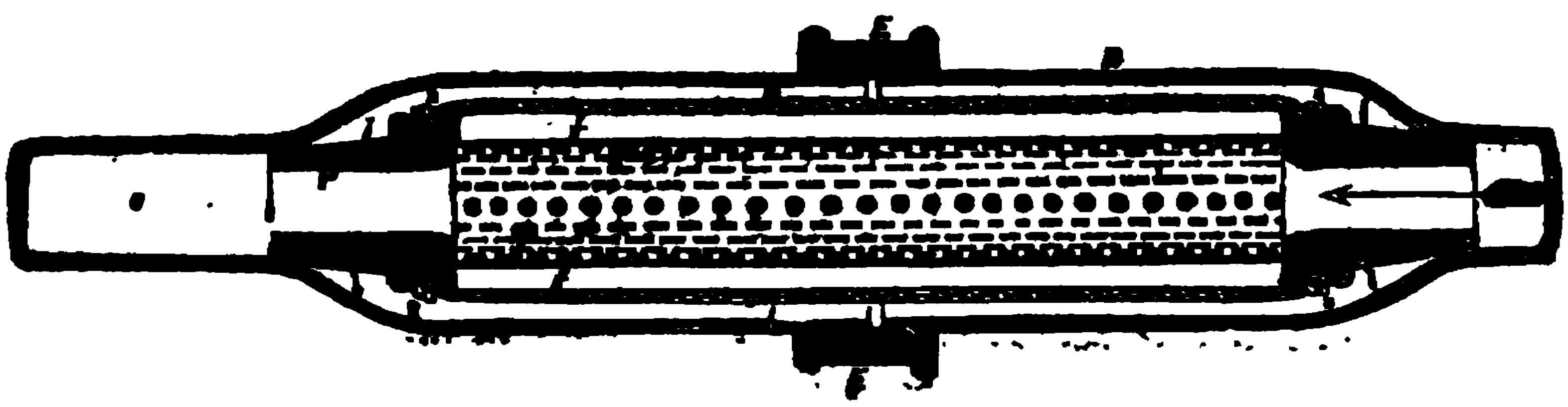


Fig. 2.



Sir,—Allow me to introduce to your notice a "Self-Cleansing Tubular Filter," (Registered April 8, 1850), offering several very considerable advantages, which I believe have never yet been combined in any one filter. The pure water question is now so prominently before the public, and is engrossing so much attention, that it is very probable many of your numerous readers will take an interest in this filter; I shall therefore be greatly obliged if you will devote a small space in your valuable Magazine to the accompanying description and diagrams, at an early period.

The prevailing filtering medium now in use, is composition porous stone, differently prepared, and differently applied. I admit that perfectly clear water is obtained, and in a sufficient stream,—*for a time*,—but the stone soon becomes choked by use, and cannot be properly cleaned; therefore the filter case must be fitted with a new medium, which is nearly as costly as an entirely new filter. There is no method in general use of

clearing the medium thoroughly and frequently, whether porous stone or no, therefore they all become inefficient in their action in a short time, and are expensive.

The apparatus I am about to describe, is by far the cheapest which has yet been laid before the public, and without claiming any advantages it does not possess, I will engage to show that it is also, in many respects, the best.

In the accompanying diagrams, drawn to a scale of 3 inches to a foot, fig. 1 is an elevation of the "Registered Self-Cleansing Tubular Filter," in a complete state; and fig. 2 is a longitudinal section of fig. 1.

The apparatus consists of a perforated metal tube T (copper being preferred), covered with several layers of flannel, *ff*, and calico, *cc*. The ends of the perforated tube are inserted in metal rings, *rr*, and the extremities of the calico are secured round the rings at *ss*, forming a water-tight fastening. The filtering medium is therefore flannel and calico. The metal rings are partly covered with a conical leather-washer, *ll*, which also ensures a water-tight joint between the dirty and the filtered water. This very simple and inexpensive arrangement, enclosed in the outer case, DD, constitutes the whole of the filtering apparatus. The method of applying it is considered to be a very important improvement; it consists in attaching it to the service-pipe *a*, between the cistern and the water-tap A; thus bringing the pressure of the column of water from the cistern into use.

The diagrams show the outer case, DD, in halves; the one being attached to the service-pipe *a* from the cistern, the other having a short service-pipe *e*, fitted with the tap A. The filtering tubes are put into one half, and the other part is brought up, and screwed on, as shown at E. The water, flowing in the direction of the arrow percolates through the flannel and calico, into the space, *bb*, whence it is drawn off, perfectly filtered, by the lesser tap B; and the water for household purposes is drawn from the larger tap A, after having rushed through the tube T; the filter being thereby effectually cleansed from the impurities it had collected in filtering, every time water is drawn from the tap A.

This is the first instance of the pressure of the column of water from the cistern being made use of; and another advantage derived from it, besides the thorough cleansing of the filter, is that it keeps up a large and rapid stream of pure water. The position of this apparatus renders it exceedingly convenient, obviating the trouble of refilling it, as in others.

The chief advantages of this "Self-Cleansing Tubular Filter," are,—its cheapness, its lasting efficacy, its convenient position, and the continued full stream of pure water obtained from it.

Having, I trust, fully explained the subject, and established its claim to superiority, apologizing for having so far trespassed on your valuable space,

I am, Sir, yours, &c.,

WILLIAM MURRAY.

20, John-street, Adelphi, March 31, 1851.

LORD BROUGHAM'S PATENT LAW AMENDMENT BILL, INTITULED "AN ACT FURTHER TO AMEND THE LAW TOUCHING LETTERS PATENT FOR INVENTIONS."

Whereas it is expedient to make certain additions to and alterations in the present law touching Letters Patent for inventions: Be it enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords spiritual and temporal, and Commons, in this present Parliament assembled, and by the authority of the same; as follows:—

I. It shall be lawful for Her Majesty to cause Letters Patent for Inventions to be made and issued under the Great Seal of the United Kingdom of Great Britain and Ireland, in the manner and of the force and effect hereinafter mentioned.

II. The Lord Chancellor, the Master of the Rolls, Her Majesty's Attorney General for England, Her Majesty's Solicitor General for England, the Lord Advocate, Her Majesty's Solicitor General for Scotland, Her Majesty's Attorney General for Ireland, for the time being respectively, shall be Commissioners of Patents for Inventions; and it shall be lawful for any three of the said Commissioners, the Lord Chancellor or the Master of the Rolls being one, to exercise all the powers hereby vested in the Commissioners, and not otherwise provided for by this Act.

III. It shall be lawful for the said Commissioners, and they are hereby empowered and required, from time to time to make such rules and orders respecting applications for and the making and issuing of

Letters Patent, the filing, preservation, and publication of specifications, the preparation and publication of indices thereto, the access of the public to specifications and copies thereof, applications for and allowance of disclaimers and memoranda of alterations, and other matters and things in anywise touching and concerning the premises as may be necessary, and are not herein provided for; and it shall be lawful for the said Commissioners from time to time to appoint such officers, clerks, and servants as may be necessary for the execution of the powers hereby vested in the Commissioners, and at their pleasure to remove such officers, clerks, or servants, or any of them.

IV. The petition for the grant of Letters Patent shall be left at the Great Seal Patent-office, and the day of the delivery thereof at such office shall be then and there recorded by the Clerk of the Patents, and the Letters Patent granted upon such petition may be sealed and bear date as of the day of the delivery and recording of the petition for the same at the said office; provided always that nothing herein contained shall authorise the making of such Letters Patent to be sealed and bear date as of a day prior to such delivery and recording; provided also, that the Clerk of the Patents shall cause all such petitions to be marked with progressive consecutive numbers, as the same are delivered and recorded at the said office, and shall give a receipt for every such petition to the person leaving the same.

V. The petition for the grant of Letters Patent shall be referred to such person or persons as the Commissioners shall from time to time appoint to consider and report thereon; and every report recommending the grant of Letters Patent shall be accompanied by a statement in writing describing the nature of the invention for which the Letters Patent are sought, signed by or on behalf of the applicant for such Letters Patent, and certified by the person or persons making such report, in such manner as the Commissioners may direct.

VI. The Commissioners, on the receipt of the report, signed and certified in such manner as they may direct in favour of the grant of Letters Patent, shall cause a warrant for the sign manual of Her Majesty to be made out, which warrant shall set forth the Letters Patent to be granted; and such warrant, signed by Her Majesty, shall be the warrant to the Lord Chancellor for the making and sealing of the Letters Patent therein directed to be made.

VII. It shall be lawful for the Lord Chancellor, on the receipt of the warrant signed by Her Majesty, to cause Letters Patent to be made and issued under the Great Seal of the United Kingdom of Great Britain and Ireland; and such Letters Patent, so made and issued, shall be of the same validity and of like force and effect throughout the United Kingdom of Great Britain and Ireland, the town of Berwick-upon-Tweed, the Channel Islands and Isle of Man, and in all the Colonies and possessions abroad, and in every part of the same, and admissible in evidence in the same manner as any Letters Patent heretofore issued under the said Great Seal, or under any other Seal heretofore used for sealing grants of like nature in such part of the United Kingdom of Great Britain and Ireland, or in Scotland or Ireland respectively; provided always that the sealing of such Letters Patent may be opposed before the Lord Chancellor, by or on behalf of any person or persons, in the same manner as grants of like nature have heretofore been opposed.

VIII. It shall be lawful for Her Majesty to cause all Letters Patent to be made subject to the condition that the same shall be void, and that the powers and privileges thereby granted shall cease and determine, at the expiration of three years and seven years respectively from the date thereof, unless there be paid in respect of such Letters Patent before the expiration of the said three and seven years respectively, or at such time as may be therein provided, the sum or sums of money by way of stamp duty in the schedule to this Act mentioned, and unless the said Letters Patent, or an office copy of the warrant therefor in case the Letters Patent shall have been lost, with the stamp appearing thereon, be brought to the Great Seal Patent-office for registration, and the Clerk of the Patents is hereby required to register the same, and to endorse on such Letters Patent, or on the office copy of the warrant therefor, a certificate of such registration: provided also, that all Letters Patent may be made subject to such other conditions for rendering the same void or voidable, as to Her Majesty may seem fit.

IX. All specifications filed in pursuance of any condition contained in any Letters Patent granted as aforesaid, shall be preserved in such manner and subject to such regulations as the Commissioners may from time to time direct; and in case reference shall be made in such specification to any drawings, an extra copy of such drawings shall be left with such specification at the office at which the same is to be filed.

X. It shall be lawful for the Lord Chancellor and the Master of the Rolls to direct the enrolments of specifications, disclaimers, and memoranda of alterations heretofore or hereafter enrolled or deposited at the Rolls Chapel-office, or at the Petty Bag-office,

or at the Enrolment-office of the Court of Chancery, or in the custody of the Master of the Rolls as Keeper of the Public Records, to be transferred to such office as the Commissioners may direct; and it shall be lawful for the Commissioners to provide, and from time to time to vary, the seal or stamp of such office, and all the provisions now in force respecting the seal or stamp of the office from which such specifications may be removed shall be applicable and apply to the seal or stamp of the office to which the same shall be removed, as fully and effectually as if such provisions were repeated and re-enacted in this Act.

XI. The Commissioners shall cause true copies of the specifications of all Letters Patent granted as aforesaid, and of all disclaimers and memoranda of alterations in such Letters Patent and specifications, to be open to the inspection of the public at the Great Seal Patent-office at all reasonable times.

XII. The Commissioners shall from time to time cause the specifications of all Letters Patent granted as aforesaid, and all disclaimers and memoranda of alterations in such Letters Patent and specifications, to be printed by Her Majesty's printer, and to be published and sold at reasonable prices, and such printed copies shall be admissible in evidence, and deemed and taken to be *primâ facie* evidence of the existence and contents of the documents to which they purport to relate in all courts and in all proceedings relating to such Letters Patent or specifications.

XIII. Any person to whom Letters Patent shall be granted as aforesaid, either alone or jointly with any other person or persons, or any person who shall acquire an interest in such Letters Patent, either legal or equitable, whether as owner of the said Letters Patent or of any share therein, or as the sole and exclusive licencee under such Letters Patent, may enter with the Clerk of the Patents at the Great Seal Patent-office, having first obtained the leave of the said Commissioners, certified by the fiat and signature of two of such Commissioners, a disclaimer of any part either of the title of the invention or of the specification, or may with such leave as aforesaid enter a memorandum of any alteration in such title or specification, not being such disclaimer, or such alteration as shall extend the exclusive right granted by the said Letters Patent and specification; and such disclaimer and memoranda of alteration, certified as aforesaid, being filed with the warrant for the said Letters Patent, and filed with the specification of the said Letters Patent, shall be deemed and taken to be part of such Letters Patent or such specification in all courts whatever; and no objection shall be allowed to be made in any proceeding upon or touching such Letters Patent, disclaimer, or memorandum of alteration on the ground that the party applying for and entering such disclaimer and memorandum of alteration as aforesaid had not sufficient authority in that behalf: provided always, that any person may enter a caveat against the granting of such leave as aforesaid at the Great Seal Patent-office, and which caveat shall give the party entering the same a right to be heard before the said Commissioners in opposition to such application; provided also, that the said Commissioners may require the party applying for such leave as aforesaid to give notice thereof by advertisement, in such manner as they may see fit, and shall, if they require such advertisement, certify in their fiat that the same was duly made; provided also, that it shall be lawful for the said Commissioners to allow any such disclaimer or memorandum of alteration upon such conditions as they may see fit, and which conditions shall be stated in their said fiat; provided also, that no such disclaimer or memorandum of alteration shall be receivable in evidence in any proceeding at law or in equity, save and except any proceeding by *scire facias* to repeal the Letters Patent pending at the time when such disclaimer or memorandum of alteration was enrolled; but in every such proceeding, save and except any proceeding by *scire facias* to repeal the Letters Patent, the original title and specification alone shall be given in evidence, and deemed and taken to be the title and specification of such Letters Patent.

XIV. All disclaimers heretofore or hereafter entered with such leave, and certified as in the first section of the Act of the fifth and sixth years of William IV., chapter 83, mentioned by the grantee or grantees of such Letters Patent, or by one of such grantees, or by any person having an interest in such Letters Patent, either legal or equitable, or by any grantee jointly with any person having such legal or equitable interest, shall be valid notwithstanding any person to whom the said Letters Patent, or any share or interest therein, may have been assigned may not have concurred or joined in such disclaimer or memorandum of alteration; and no objection shall be allowed to be made in any proceeding touching such Letters Patent, disclaimer or memorandum of alteration on the ground that the party applying for and making such disclaimer or memorandum of alteration had not sufficient authority in that behalf.

XV. All the provisions of the Act of the

fifth and sixth years of William IV., chapter 83, for the confirmation of any Letters Patent, shall be applicable and apply to any Letters Patent granted as herein authorized; and all the provisions of the said Act and of the Acts of the second and third years of Her Majesty, chapter 67, and seventh and eighth years of Her Majesty, chapter 69 respectively, relating to the extension of the term of Letters Patent, and to the grant of new Letters Patent for a further term, shall be applicable and apply to any Letters Patent granted as herein mentioned; and it shall be lawful for Her Majesty to grant any new Letters Patent as in the said Acts mentioned in the manner hereby authorized: provided always, that such new Letters Patent shall extend to and be available in and for such part or parts only of the realm as the original Letters Patent extended to and were available in, and such new Letters Patent shall be valid in, and for such part or parts of the realm notwithstanding publication or user of the invention in any other part of the realm after the making and granting of the original Letters Patent: provided also, that such new Letters Patent shall be sealed and bear date as of the day after the expiration of the term of the original Letters Patent which may first expire.

XVI. In any action for the infringement of Letters Patent, the plaintiff shall deliver with his declaration particulars of the breaches complained of in the said action, and the defendant on pleading thereto shall deliver with his pleas, and the prosecutor in any proceeding by *scire facias* to repeal Letters Patent, shall deliver with his declaration, particulars of any objections on which he means to rely at the trial in support of the pleas in the said action, or of the suggestions of the said declaration in the proceedings by *scire facias* respectively; and at the trial of such action or proceeding by *scire facias* no evidence shall be allowed to be given in support of any alleged infringement or of any objection impeaching the validity of such Letters Patent which shall not be contained in the particulars delivered as aforesaid; provided always, that it shall and may be lawful for any judge at chambers to allow such plaintiff, or defendant, or prosecutor respectively to amend the particulars delivered as aforesaid upon such terms as to such judge shall seem fit.

XVII. In taxing the costs in any action commenced after the passing of this Act for infringing Letters Patent, regard shall be had to the particulars delivered in such action, and the plaintiff and defendant respectively shall not be allowed any costs in respect of any particular not certified by the judge before whom the trial was had to have been proved by such plaintiff or defendant respectively, without regard to the general costs of the cause; and it shall be lawful for the judge before whom any such action shall be tried to certify on the record that the validity of the Letters Patent in the declaration mentioned came in question, and the record with such certificate being given in evidence in any suit or action for infringing the said Letters Patent, or in any proceeding by *scire facias* to repeal the Letters Patent, shall entitle the plaintiff in any such suit or action, or the defendant in any such proceeding by *scire facias*, on obtaining a decree, decretal order, or final judgment, to his full costs, charges, and expenses, taxed as between attorney and client, unless the judge make such decree or order, or the judge trying such action or proceeding, shall certify that the plaintiff or defendant respectively ought not to have such full costs.

XVIII. The payment to be made in respect of Letters Patent applied for or issued as herein mentioned, the filing of specifications of such Letters Patent, the making, filing, and entering of disclaimers and memoranda of alterations, the certificates and searches, and other matters and things relating thereto, and the stamp duties to be paid thereon, shall be the sums in the schedule to this Act annexed, and no other stamp duties shall be levied or fees taken in respect of such Letters Patent and specifications, and the matters and things therein mentioned.

XIX. And whereas officers and divers other persons are entitled to fees or charges payable in respect of Letters Patent as heretofore granted within the United Kingdom of Great Britain and Ireland, or have, or derive in respect of such Letters Patent, fees or other emoluments or advantages from offices or appointments, and such fees, charges, emoluments, advantages, offices, and appointments, or some of them, will be abolished, superseded, taken away, diminished, or interfered with by the passing, or under the operation of this Act; and it is right that every such person so affected should have a fair and just compensation in that behalf: Be it therefore enacted that every such person so effected shall be entitled to such compensation to be made in that behalf, as follows; that is to say, every such person may, within six months after the passing of this Act, make to the Lords Commissioners of Her Majesty's Treasury a claim for such compensation, and every such claimant shall deliver to them a statement in writing of the nature, duties, and amount of his fees, charges, emoluments, advantages, office, or appointment, and of the extent to which, and the manner in which the same respectively are or will be

so affected; and the Lords Commissioners of Her Majesty's Treasury, or such persons as they shall appoint in that behalf, shall have power thereupon to examine the claimant, and in such manner as they may think fit to inquire into the premises; and the Lords Commissioners of Her Majesty's Treasury may, as they shall think fit, award a fair and just compensation to every such claimant, either as a gross or yearly sum, and for such time as upon consideration of the special circumstances of the case they may think just; and all such compensation shall be paid out of the consolidated fund of the United Kingdom of Great Britain and Ireland: provided always, that in case any person to whom any yearly sum by way of compensation shall be awarded, shall, after the passing of this Act, be appointed to any office or place of emolument in Her Majesty's service or otherwise under the provisions of this Act, then, and in every such case, the amount of such yearly sum shall in every year be diminished by so much as the emoluments of such person for such year from such office or place shall amount to, and provision in that behalf shall be made in the award to him of such yearly sum.

XX. The terms and expressions hereinbefore used, so far as they are consistent with, and not repugnant to the contents of this Act, shall be construed as follows; (that is to say)

The expression "Lord Chancellor," shall mean the Lord Chancellor, or Lord Keeper of the Great Seal, or Lords Commissioners of the Great Seal.

The expression "Commissioners" shall mean the Commissioners for the time being acting in execution of this Act.

The expression "Letters Patent" shall mean Letters Patent for inventions.

The expression "Invention" shall mean "the working or making of any manner of new manufactures within this realm," within the meaning of the Act of the 21st year of King James I.

XXI. In citing this Act in other Acts of Parliament, instruments, and proceedings, it shall be sufficient to use the expression "The Patent Law Amendment Act, 1851."

XXII. This Act shall commence and take effect one month from the passing thereof.

THE SCHEDULE TO WHICH THIS ACT REFERS.

Fees to be taken and Paid in the Great Seal Patent-office.

	£	s.	d.
On leaving Petition for grant of Letters Patent for an Invention for the United Kingdom of Great Britain and Ireland	10	0	0
On Warrant for Her Majesty's Sign Manual, and for Letters Patent for the United Kingdom	8	0	0
On filing Specification of such Letters Patent, and for Registration thereof	2	0	0
Registration of Payment of further stamp duty of 40*l.* before the expiration of the third year of such Letters Patent, and for Certificate	0	5	0
The like, on payment of further stamp duty of 70*l.* before the expiration of the seventh year of such Letters Patent, and for Certificate	0	5	0
For every search for, and inspection of, any Record at the Great Seal Patent-office............	0	1	0
For Record or Notice of Disclaimer of Memorandum of Alteration under the Act of the 5th and 6th of William IV., chapter 83	0	5	0
For record of every Caveat or Notice of Opposition	0	5	0

Stamp Duties to be Levied and Taken under this Act.

	£	s.	d.
Stamp Duty on granting Letters Patent for an Invention for the United Kingdom of Great Britain and Ireland	10	0	0
Additional Stamp Duty on such Letters Patent, to be paid on or before the expiration of the third year from the date of such Letters Patent	40	0	0
Additional Stamp Duty on such Letters Patent, to be paid on or before the expiration of the seventh year from the date of such Letters Patent..........	70	0	0

MR. FROST'S "STAME."—REPLY TO DR. HAYCRAFT. BY MR. FROST.

Sir,—Your learned correspondent, Dr. Haycraft, seems greatly displeased at my objecting to his unscientific term (anhydrous, or waterless steam), that being an impossibility. It ought never to have been introduced into any scientific discussion, wherein strict truth alone is of any value; and I therefore hope, if he has been offended at my needful remarks, he will cease to be so, as well as the author of another as great stumbling-block in the way of any great improvement in the use of steam.

For, a correspondent of yours having inquired of your readers the law as to proportion of power required for double velocity of steamers, you have published an

answer you received thereto; namely, that eightfold force or fuel would be required for double speed. Were this "fact," it would be hopeless to expect its attainment; while, on the contrary, I expect to see double speed of steamers attained by the scientific consumption of only one-half the fuel now employed therein. Because, though your correspondent states that eightfold power will be required for double speed, Sir Isaac Newton, who used to be considered as pretty good authority on this subject, states, in the "Principia," that double speed requires only double power, treble speed requires treble power, and so on. If your correspondent will experiment, as I have often done, with two model boats of the same exact form and weight, drawn on water by cords (passing over pullies), having different weights attached thereto, he will find that double weight produces double speed, treble weight produces treble speed, in exact accordance with the illustrious Newton's laws.

Yet, in a late dispute in the New York papers, the same false position is advanced by one party, with the awful addition that treble speed requires twenty-seven fold power; and as all those statements remain uncontradicted by the other party, it must be taken for granted that neither party knows any better, though one passes for a learned professor, and the other for a gentleman in the largest practice in constructing steam engines. While such enormous errors pass current as truth, the difficulty of introducing any new truth, however important, ceases to be surprising.

The sum and substance of my useful chemical discovery may be stated in a very few words:—

Steam being a definite compound of water and heat; therefore eight volumes of steam contain eight times as much heat, and eight times as much water as one volume contains. But if a volume of steam is heated apart from water, the addition of only one-fifth part or quantity of the heat contained in the original volume of steam increases the volume of steam eightfold; and this cheaply and chemically enlarged volume of elastic fluid of equal tension, in contradistinction to the definite and costly chemical compound steam, I have for convenient and necessary distinction denominated "stame."

Dismissing, therefore, all puerile verbiage that leads to nothing useful, let us look at the incomparable value of this new and better gift of Providence.

For, as an equal volume of elastic fluid of equal tension may be obtained from one-sixth the fuel or cost; therefore a propeller sent in search of Sir John Franklin could steam with equal speed six times as long a time as any steamer hitherto constructed.

Again; Collins's steamers could make a voyage between New York and Liverpool with much less than one-fourth the fuel, and half the boilers employed; and therefore start with this lesser displacement of 800 tons, they would travel faster also.

With the same vessels, with properly constructed boilers, heaters, and adapted machinery, it may be satisfactorily demonstrated to competent persons, that one-half the fuel now employed would propel those steamers in half the time now uselessly and ignorantly consumed by the use of steam.

As in my pamphlet I have fully described all necessary, yet cheap and simple instruments, and their requisite manipulations, in proof of every distinct fact advanced, and which defy contradiction, I shall conclude by saying, my oft-repeated experiments on engines, &c., in presence of competent and inquisitive judges, will fully warrant my undertaking to realise all of the aforesaid advantages, and it is both my expectation and opinion that no performance of art about to be exhibited in the Crystal Palace, will equal this curious chemical discovery in usefulness, economy, novelty, or in general advantage to mankind.

I am, Sir, yours, &c.,
JAMES FROST,
Engineer.

Fulton-avenue, Brooklyn,
New York, March 26, 1851.

THE HILLOTYPE, OR DAGUERREOTYPING IN COLOURS.—(SEE *ante*, P. 273.)

We extract the following additional information on the subject of this remarkable discovery, from a communication by Mr. Hill to the (American) *Photographic Art Journal:*

"The discovery is due to some chemical compound, a nondescript to me, though I have made the science of chemistry my study for years. That it is a new substance, or combination of substances, I am positive; and this is all I know concerning it. It is simply and easily produced, but not by any law stated in the large number of chemical works with which I am familiar. Doubtless, however, a correct and thorough analysis will determine its nature."

[Mr. H. had forty specimens of pictures taken by his discovery at the date of his letter. Three of these are thus described:]

"1. A view, containing a red house, green grass and foliage, the wood colour of the trees, several cows of different shades of red and brindle, coloured garments on a clothes-line, blue sky, and the faint blue of

the atmosphere; intervening between the camera and the distant mountains, very delicately spread over the picture as if by the hand of a fairy artist.

"2. A sunset scene, in which the play of colours upon the clouds is impressed with a truthfulness and gorgeous beauty which I cannot describe.

"3. Several portraits, in which I have the true complexion of the skin, the rosy cheeks and lips, blue and hazel eyes, auburn, brown, and every colour of the drapery. Changeable silk is given in all its fine blendings of colours, and delicate richness of hues. I not only get red, blue, orange, violet, &c., but their various tints. The whole impression, including the lights and shades, is far more brilliant, round, and mellow, than the most superb daguerrean image I have ever seen."

Mr. Hill adds:

"I have a most exquisite type of my little girl (one year old), taken in the act of *crying*, the plate not having been exposed a full second. At the same time, my light required fifteen seconds for a daguerreotype. This picture has caught the expression perfectly, both of the eye and whole face. On one cheek is seen a bright tear-drop, and the colour showing through it much deeper than the surrounding parts; which latter, I suppose, is owing to the refractive action of the fluid."

The only difficulty stated to be now experienced is in taking yellow colours.

SCREW PROPELLER.

Sir,—The following may be interesting to your correspondent, "R. H. K.," (p. 190, vol. liv). Translated from "Recherches sur l'Art de Voler, par M. David Bourgeois." Paris, 1784, p. 87. "M. Vallet, director of the manufactory of acids at Javelle, has had a wheel-propeller made and fitted upon a boat. It is set in motion by manual labour. It is composed of inclined planes, which strike *the air* without interruption, and thus procure the speed. I have passed and repassed the Seine in this boat, which carried twelve of us. The stream was swifter than usual. Our transit and return occupied eight minutes and a half, while another boat with two oars, carrying five men, at the same time took ten minutes in the passage..... And the wheel is far from perfect in its construction, which was very carelessly executed."

Of course, a screw propeller applied to the air would answer just as well as one worked in the water, but its surface must be as much greater than that of the water-vanes, as the air is lighter than water; viz., about 810 times; and the point of application of the force must be so situated as to waste the least possible amount of power in twisting the vessel round its shorter horizontal axis, and in so causing the bows to dip into the water. M.

April 9, 1851.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING APRIL 10, 1851.

William Tudor Mabley, of Manchester, patent agent. *For certain improvements in the manufacture of soap.* Patent dated October 3, 1850.

The object of this invention is to produce, from crude turpentine, a resin soap, which may be used either in combination with grease soap or alone.

The inventor first melts, by steam or otherwise, 1000 parts of crude turpentine, and adds to this 400 parts of a solution of soda containing 33 per cent. of pure dry soda. The effect of this is to neutralize the natural acids, and set free the essential oil contained in the turpentine. In order to separate the latter, a solution of common salt in water is added to the saponaceous mass, and the vessel containing it connected with a condensing apparatus, such as is used by distillers of spirits of turpentine. Heat is then applied, and the essential oil driven off with the steam which rises from the mixture, and condensed in the condensing apparatus. The soap will be found floating on the surface of the saline solution. The inventor prefers to use this latter, as being of greater specific gravity than water, and equally well adapted for producing steam. It is not, however, essentially necessary. Another method, which has been found to answer well, is to use a ley of less strength than that above mentioned—say about 20° Beaumé—half of the necessary quantity only being at first added to the melted turpentine, and the remainder introduced during the process of distillation in a ratio equal to the quantity of spirit and water that comes over in the still. A solution of soda ash in water may also be used; but great care is requisite under these circumstances, carbonic acid gas being produced in large quantities during the process. (One pound of soda, caustic or carbonated, containing 50 per cent. of pure soda, is sufficient to saponify four pounds of turpentine.) In order to

remove any colouring matter which may be extracted from the turpentine, the soap is to be washed in a solution of salt and water. The resin soap thus produced is suitable for use alone, or may be combined with grease soap of any kind. A good light-coloured article may be made by mixing 100 lbs. of good grease soap with 200 lbs. of the resin soap produced as above. The spirit of turpentine which results from this distillation is rather different from that produced by the ordinary processes. It is well adapted for burning in lamps, as it gives a bright flame, and leaves no residuum.

Claims.—1. The making of resin soap from crude turpentine, without the use of tallow, fat, or grease.

2. Distilling the essential oil of turpentine, as above described, to form soap.

Jean Pierre Paul Amberger, of Paris, civil engineer. *For certain improvements in the application of magnetic power for moving and stopping carriages, for giving adherence to wheels upon rails, and also for transmitting motion.* Patent dated October 3, 1850.

1. The patentee proposes the application of what he terms electro-brakes (electro-magnets with their poles either in contact with the rails, or suspended above them, and capable of being lowered at pleasure), to effect the stoppage of railway carriages. These brakes may be attached to any number of a train of carriages, and connected in the same circuit, so as to be brought into action simultaneously.

2. Adherence between the rails and wheels of carriages is obtained either by electro-magnets attached to the carriages, and exerting their attractive force on the rails, or by direct contact of electro-magnets with the rails, the tyres of the wheels being the electro-magnets.

3. In order to apply the transmission of magnetic power to giving motion to trains, the patentee connects the wheels of each of the carriages together by cranked rods, to which are attached electro-magnets at suitable distances above the rails. The magnets come into operation intermittently and alternately, and the consequent rising and falling of the connecting rods causes the wheels to rotate and propel the carriages.

Claims.—1. The application of magnetic power to brakes upon railways.

2. The application of magnetic power to give adhesion to wheels of carriages on rails.

3. The employment of iron-filings (in making the electro-magnets) to increase the surface of contact.

4. The application of magnetic power to moving carriages as described.

5. The application and use of the said magnetic power as a motive power, as described.

Thomas Hoskins Howels, of Amelia-row, Landport, Portsea, gunner. *For improvements in gun-carriages.* Patent dated December 12, 1850.

The object of Mr. Howels's improved gun-carriage is to admit of broadside guns of any description being mounted efficiently without the cumbersome slides and carriages at present in general use in the Royal Navy. The rear axle of the carriage, which is provided at bottom with friction plates, rests on the deck, and supports the gun in the loading and firing positions. In each end of this axle is formed a vertical socket, to receive a sliding spindle, which is capable of turning round freely, projects a little above the level of the top of the axle, and carries at its lower end a truck or roller. At each end of the axle is hinged a lever, extending in the direction of the muzzle of the gun, and passing over the projecting portions of the truck spindles. When the gun is to be run out or pointed in either direction, the levers on each side are simultaneously depressed, and the rear axle is thereby raised from the deck, and the weight of the gun and carriage thrown on to the trucks or rollers, which, being mounted on spindles capable of turning round freely in their sockets, act like "castors," and admit of the gun being readily run out and pointed in either direction.

Julian Bernard, of Buchanan-street, Glasgow, artist. *For improvements in pneumatic springs, buffers, pumps, and stuffing-boxes.* Patent dated October 4, 1850.

1. Mr. Bernard describes his improvements as applied to a hydrostatic press. In this case, a flexible tube is applied inside the water cylinder, one end of said tube being fastened at the bottom of the cylinder, and the other end folded in and secured to the extremity of the ram—thus obviating the necessity of having a watertight stuffing-box. In working this press, water is forced into the interior of the flexible tube, distending it longitudinally, and actuating the ram attached to it.

2. A railway buffer is described as fitted with a flexible tube in a similar manner. A certain quantity of water is introduced into this buffer, to prevent the end of the rod coming home against the cylinder when under compression. If desired, the whole of the interior of the buffer may be filled with water or compressed air may be employed in conjunction with a small quantity of liquid, in place of air at the ordinary pressure.

These illustrations are deemed sufficient

to show the manner of applying a flexible tube according to the patentee's method in other instances where the same may be employed.

Claim.—The application of a flexible tube turned in or folded over for the purposes described.

Cyprien Theodore Tifferau, of Paris, gentleman. *For certain improvements in hydraulic clocks.* Patent dated October 3, 1850.

Two exemplifications are given by the patentee of these improvements, and both founded on the same principle.

1. A syphon is fixed in an upright position on a float which is placed in a vessel containing water. The syphon discharges the water into a second vessel underneath, and the level of the water in a tube connected with the water vessel indicates the passage of time.

2. Or the falling of the syphon itself effects the same object. In each case the hours are marked on a vertical scale graduated according to the quantity of water discharged by the syphon in a given time. Two modifications of the apparatus are also described, in which the time is indicated by hands on a circular dial.

William Boggett, of St. Martin's-lane, gentleman, and Wm. Smith, of Margaret-street, Cavendish-square, engineer. *For improvements in producing and applying heat, and in engines to be worked by steam or other elastic fluid, which engines are also applicable as pumps.* Patent dated October 3, 1850.

The first branch of this patent comprehends a great number of new methods of heating by gas, or gas intermixed with atmospheric air. Some of the more prominent of these we shall give, with engravings, in an early Number.

The second includes a new rotary engine of remarkably simple construction; a full description of which forms the first article of our present Number.

Novel Application in Mechanics.—Mr. Alfred Smee has announced that he has contrived a piece of mechanism of much novelty. And he states that by it he can show the relation of any number of facts or principles inductively and deductively, and thus perform mechanically what has hitherto been thought to be the province of the mind alone. For the action of the machine, he so arranges the words that every word forms a half of the meaning of the word above it, and comprises the meaning of two words below it. By these means he obtains an arrangement of words having the properties of a Geometrical Series. When the words are expressed in their proper relations upon the machine, which is constructed upon the same geometrical plan, with the logical readings of All, Some, None, the bearings of any number of actions on the machine is indicated, and the conclusion can be read by inspection.—*Morning Post.*

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Barker, of Hulme, near Manchester, millwright, for improvements in machinery for chipping, rasping, and shaving dyewood, and other materials, and in apparatus connected therewith. April 7; six months.

Christopher Cross, of Farnworth, near Bolton, Lancaster, cotton spinner and manufacturer, for certain improvements in the manufacture of textile fabrics, and in the manufacture of wearing apparel from textile materials. April 8; six months.

John George Appold, of Finsbury-square, gentleman, for improvements in machinery for regulating and ascertaining the labour performed by manual or other power. April 9; six months.

Charles M'Dowall, of Hide-street, Bloomsbury, Middlesex, watchmaker, for certain improvements in the construction of time-keepers. April 10; six months.

LIST OF SCOTCH PATENTS FROM 22ND OF FEBRUARY, TO THE 22ND OF MARCH, 1851.

Adolphus Oliver Harris, of High-Holborn, Middlesex, philosophical instrument-maker, for improvements in barometers. (Being a communication.) February 26; six months.

Joseph Crossly, of Halifax, carpet manufacturer, George Collier, of the same place, mechanic, and James Hudson, of Littleborough, printer, for improvements in printing yarns for, and in weaving carpets and other fabrics. March 3; six months.

George Smith, of Manchester, Lancaster, engineer, for certain improvements in steam engines, and also improvements in feeding or supplying the boilers of same, part or parts of which improvements are also applicable to other similar purposes. March 4; six months.

John Hetherington, of Manchester, Lancaster, machinist, for improvements in machinery for preparing, spinning and manufacturing fibrous substances. March 4; six months.

Alfred Cooper, of Rumsey, Hants, for improvements in steam and other power engines, and in the application thereof to motive purposes; also in the method of, and machinery for, arresting or checking the progress of locomotive engines and other carriages. March 5; six months.

Henry Richardson, of Aber Hernant, Balda, North Wales, esq., for certain improvements in life-boats. March 7; six months.

William Stones, of Queen's-hythe, London, stationer, for improvements in the manufacture of safety paper for banker's cheques, bills of exchange, and other like purposes. March 7; six months.

Joseph Baldwin, and George Collier, mechanics, and Joseph Crossley, all of Halifax, for improvements in the manufacture of carpets, and other fabrics. March 12; six months.

George Roberts, of Selkirk, Scotland, manufacturer, for an improved manufacture of certain yarns of linen, wool, silk, cotton, and other fibrous substances. March 13; six months.

Samuel Brisbane, of Manchester, Lancaster, pattern maker, for certain improvements in looms for weaving. March 14; four months.

George Guthrie, of Appleby, Chamberlain to the Right Hon. the Earl of Stair, and residing at Rephad, by Stranraer, Wigton, for improvements in digging, tilling, and working land. March 14; six months.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of 166, Fleet-street, London, patent agent, for improvements in purifying water, and preparing it for engineering, manufacturing, and domestic purposes. March 17; six months.

Edward Lloyd, of Dee Valley, Merioneth, North Wales, engineer, for certain improvements in steam

engines, which improvements are in part, or on the whole, applicable to other motive power. March 17; four months.

William Eccles, of Walton-le-Dale, Lancaster, cotton spinner, for certain improvements in looms for weaving. March 17; six months.

Herbert Taylor, of 46, Cross-street, Finsbury, Middlesex, merchant, for certain improvements in the manufacture of carbonates and oxides of barytes and strontia, sulphur, or sulphuric acid, from the sulphates of barytes and strontia, and for consequent improvements in the manufacture of carbonates and oxides of soda and potassa. (Being a communication.) March 19; six months.

LIST OF IRISH PATENTS FROM 21ST OF FEBRUARY, TO THE 19TH MARCH, 1851.

Thomas Wicksteed, of Oldford, Middlesex, civil engineer, for improvements in the manufacture of manure. February 26.

Samuel John Pittar, of Church-lane, Clapham, civil engineer, for certain improvements in umbrellas and parasols. March 5.

Charles Xavier Thomas (de Colmar), Chevalier de la Legion d'Honneur, of Paris, France, for an improved calculating-machine, which he calls Arithmometer. March 10.

Richard Archibald Brooman, of the firm of Messrs. J. C. Robertson and Co., of 166, Fleet-street, London, patent agents, for improvements in purifying water, and preparing it for engineering, manufacturing, and domestic purposes. (Being a communication.) March 11.

Charles Bury, of Salford, Lancaster, manager, for improvements in machinery or apparatus for preparing and spinning, doubling or twisting silk waste, cotton, wool, flax, and other fibrous substances. March 12.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
April 4	2764	James Wodderspoon	Portugal-street	Sectional strengthening account-book and index band.
7	2765	George Stephens	Brownlow-street, Drury-lane	Compound elliptic spring.
8	2766	Robert Brown	Edinburgh	Torch and valve for lighting road signals and other lamps on railways.
,,	2767	Hodges and Son	Dublin	Safety tea-kettle.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

April 3	131	James Adcock	Shalden, Teignmouth	Comparative scale of the diameter and quadrant of a circle.
,,	132	Thomas Holland	South Audley-street	Boiler-cock.
4	133	John Gedge	South Wellington-street, Strand	Close joints for water, gas, or other pipes.
,,	134	Michael Roch	South-street, Finsbury	Letter envelope.
7	135	Edward Hill and Co.	Dudley	Expanding horse hoe.
,,	136	Mary Mason	Newcastle-under-Lyne	"The Crighton."
8	137	John Brady	Blackfriars-road	Safety riding-belt.
,,	138	E. R. Turner and Co.	Ipswich	Feed-regulator for steam-boilers.
,,	139	John Haselton	Salisbury-street, Lisson-grove	Safety screw cork.
9	140	A. S. Stocker	Wandsworth	Metallic embossed casket.
,,	141	E. A. Baker	Whitechapel-road	Gun-lock.
,,	142	R. C. Mansell	Ashford	Tires for railway and other wheels.
,,	143	R. C. Mansell	Ashford	Tires for railway and other wheels.
,,	144	R. C. Mansell	Ashford	Tires for railway and other wheels.
,,	145	R. C. Mansell	Ashford	Tires for railway and other wheels.
,,	146	William Collimore	Whitechapel-road	Traveller's indispensable.
,,	147	J. R. Isaac	Liverpool	Manifold stand.
,,	148	J. A. Deveria	Calthorpe-street	Beacon advertiser.

CONTENTS OF THIS NUMBER.

Messrs. Boggett and Smith's Rotary-Engine.—Specification—(*with engravings*) 281
On Two Indeterminate Theorems. By T. T. Wilkinson, Esq., F.R.A.S. 283
On Swing-Gates and Sir John Orde's Kilmory XX Gate—(*with engravings*) 287
Description of Mr. Murray's Self-Cleansing Tubular Filter—(*with engravings*) 290
Lord Brougham's Patent Law Amendment Bill 291
Mr. Frost's "Stame."—Reply to Dr. Haycraft. By Mr. Frost 295
The Hillotype or Daguerreotyping in Colours 296
Screw Propeller 297
Specifications of English Patents Enrolled during the Week:—
Mabley ... Soap 297
Amberger ... Magnetic Power 298
Hewels ... Gun Carriages 298
Bernard ... Pneumatic Springs 298
Tiffereau ... Hydraulic Clocks 299
Boggett and Smith ... Heating and Steam-Engines 299
Novel Application in Mechanics. By Mr. Smee 299
Weekly List of New English Patents 299
Monthly List of Scotch Patents 299
Monthly List of Irish Patents 300
Weekly List of Designs for Articles of Utility Registered 300
Weekly List of Provisional Registrations 300

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MALO'S PATENT IMPROVEMENTS IN SCREW PROPELLING.

Fig. 1.

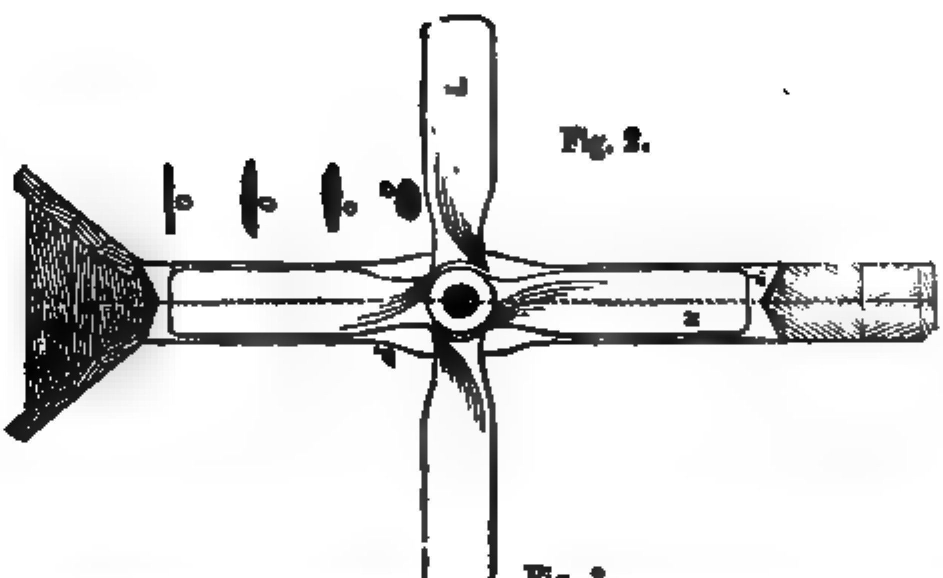

Fig. 2.

Fig. 3.

MALO'S PATENT IMPROVEMENTS IN SCREW PROPELLING.

(Patentee M. Gaspard Malo, of Dunkirk, shipowner. Patent dated June 20, 1850. Specification enrolled December 20, 1850.)

Specification.

MY invention consists; *Firstly*, in the employment for propelling vessels of a screw consisting of a series of moveable vanes or wings, which, when the apparatus is not in motion, are brought one behind the other, and the whole set behind the dead wood, so as not to interfere with the progress of the vessel when sailing.

Secondly. In a new arrangement of the end bearing of the propeller-shaft, by which the bearing is made quite independent of the stuffing-box, so that it (the bearing) may be examined, repaired, tightened, re-adjusted, or changed when needful, without its being necessary to unfix the shaft, screw, or stuffing-box.

Thirdly. In surrounding the aperture made in the dead wood to receive the screw, as also the recess in which the end bearing is placed, with a metallic frame strengthened by stays. This frame is made of one piece of gun-metal, and is so placed as to form a rabbet joint with the outside planking, thereby strengthening the dead wood so as to render it as solid as if there had been no opening made to receive the screw and bearing.

Fourthly. In facilitating the condensation of the steam for low-pressure engines when applied to the propelling of screw vessels, by means of two water tanks placed in the hold, and thereby doing away with the holes which are now bored in the bottom of vessels for condensing purposes.

I will now proceed to describe the details of these four branches of my invention:

I. *The Moveable Propelling Vanes.*

There have been hitherto two methods in use for applying the screw as an auxiliary or occasional means of propulsion; viz., either to fix the screw in such a manner that when not in use it may be detached from the propeller shaft, and hoisted up into a sort of well; or else it is so fixed that when the shaft is not in gear with the engine, the screw shall hang loosely and turn round with the water according to the speed of the vessel. Both these plans are objectionable. The first plan, among other great defects, weakens considerably the poop of the vessel, which as it is, is hardly sufficiently strong. In the second plan, whatever advantage the vessel might derive from the use of an auxiliary screw-propeller is neutralized by the continual hindrance offered by the screw to its progress when sailing. Moreover, the screw hanging loose on the end of the shaft, wears out its end-bearing almost as much as when in actual use. Consequently if, after the vessel has been sailing for some time, it becomes necessary to employ the screw, it will sometimes be found impossible to do so, owing to the bearing having become worn out before much or any use has been made of the screw itself.

These serious objections deprive merchant vessels and large men-of-war of the important advantages which they might expect to derive from the employment of an auxiliary screw. Now, my invention has for its object to remedy these defects by employing a screw with moveable vanes, and of a large diameter, in manner following: The construction of this screw is represented in detail in the annexed engravings (figs. 1 and 2). It is composed of two or three pairs of independent vanes or wings. One of these pairs is fixed on the extreme end of a shaft in the ordinary manner. A second pair is keyed on the end of a tube which encircles the shaft of the first pair. A third pair, if necessary, can be fixed in the same manner on the end of a second tube encircling the first tube. The two or three concentric shafts thus arranged one within the other, are passed after the manner of simple shafts into a tubular stuffing-box. Beyond this stuffing-box and the bearing connected therewith, these shafts are uniformly increased in diameter, and have then holes cut in them, through which (the bolts of each shaft being brought exactly in a line with those of the other or others of them) a strong key or keys is or are passed, so as to fix the two or three shafts together, and unite them as one shaft, either in the position which they respectively occupy when the screw is in movement, or in that which they occupy when it is at rest and folded back. In order to pass from one of these positions to the other, it is requisite to turn one of the shafts within the other about one-fourth, or one-sixth of a revolution, according as there may be two or three pairs of vanes. This adjustment is effected, when required, by hand (that is to say), by turning an endless screw, which works into a pinion fixed into the inner shaft.

Any other suitable mechanical arrangement may be employed for the same purpose. Be-

tween the concentric shafts, a small annular space is left of about one-fourth or one-fifth of an inch, which extends throughout their whole length, except at the bearings, and at the hinder end, where the innermost shaft is slightly increased in diameter for about a length of 3½ to 4 inches, and comes in contact for that space with the other shaft.

Should the water enter the vessel through this small annular space, that end of the innermost shaft which enters the hold should be well packed with hemp or any other suitable material. In order to diminish or prevent the possibility of the shafts sticking together, some concrete fatty matter is poured into the annular space, in order to prevent the entry of water at that place. The two or three pairs of vanes or wings are so placed and curved as to project one over the other, and in the least possible space. There remains thus between the superposed vanes only about two inches of play. The screw thus composed may in a vessel having a large draught of water have a large diameter, say of 13 or 14 feet, and even 16 feet. For an apparatus of moderate power the screw should have a sufficiently large surface, with a width of vane or wing not exceeding the thickness of the stern-post.

Four vanes or wings would suffice, but six may be used if preferred; each of the wings should be in the shape of a large oar, and made pretty much in the same manner.

The breadth of the opening made in the dead wood to receive such a screw need only be about from 18 inches to 2 feet, from the front to the back.

Thus in ships of a great draught, a sufficient portion of dead wood will be left intact above and below to render the poop solid, and this opening will allow of a sufficient width behind it to permit the stern post to be strengthened.

These arrangements may be made in a ship already built and launched without any damage being done to it, and without any modification in the shape of the bottom or submerged part of the hull.

The engaving (fig. 1) represents the fixings of a screw for an auxiliary apparatus of 150 horses power in a man-of-war. The screw is there represented with four vanes or wings; but it is easy to conceive the same with six, or any other number of vanes instead of four.

Fig. 2 is a back or stern view of the apparatus. The usual shape of the stern has been almost entirely retained, the extreme ends of some water lines only having been altered.

The shaft of the screw is placed at about 9 or 10 feet above the keel; and it may be either fixed horizontally, or it may slope upwards towards the bow, so as to be at a suitable height to allow of the attachment of any direct acting motive apparatus.

The diameter of the screw is about 14½ feet to 15 feet. The three shafts, which should resist each one-third of the entire torsion, have together an outer diameter of about 11 inches. If the shaft were of one piece only for a common screw of the same diameter, the same thread, and same rapidity of rotation (say from forty to fifty turns), it would require to be about 9¾ inches diameter. The stuffing-box should be about 13 feet in length. Behind the stuffing-box, the outer shaft is increased in diameter for about three-quarters of an inch, which obviates the usual play left in the stuffing-box.

This increased diameter affords besides greater strength for placing the keys which fix the vanes on their shafts; it gives also greater strength to the rubbing surface in the bearing.

II. *The Improved End-bearing for the Propeller-shaft.*

Hitherto an end-bearing for the shaft has been very generally dispensed with, the stuffing-box being made to answer the purpose of a bearing by inserting a small collar at the stern end; the result of this objectionable arrangement is, that when this part of the stuffing-box becomes worn away by friction, the shaft shakes about loosely in this bearing; consequently, when it is too much worn away it becomes requisite, in order to remedy the mischief, to unship the screw, the shaft, and the whole of the stuffing-box; which is a long, difficult, and very expensive operation, and not practicable with the means ordinarily at disposal on board ship. Sometimes bearings have been placed on the frame of the screw in ships in which the screw (when not required) is hoisted up into a well. These bearings, which were out quickly, owing to their shortness, can be easily got at and repaired; but still they do not do away with the necessity of another bearing at the end of the stuffing-box.

Now my improved bearing is placed in a sufficiently large recess or opening made to receive it on the fore-part of the opening through which the screw shaft passes. This recess is surrounded by the metal frame, which follows the outline of the hole made for the screw. The stuffing-box only begins at the fore edge of the recess, and therefore does not come through the recess at all. Over the lower edge of the recess there is in the metal of the frame a wide dove-tailed shaped groove, in which sliding supports are inserted. Between the supports and the shaft is a packing composed of several segments or pieces of about 4 inches in length, so that these pieces may be removed when required by withdrawing them from

between the shaft and the back of the sliding supports. Above the shaft is placed another packing, composed of two or three lengths. The cap of the bearing may also be, if required, composed of two or three pieces in the direction of its length. Then a metal wedge is driven between the top of the bearing and the upper edge of the recess; so that whatever part of the dead wood may have been cut away in order to form this recess, it is compensated for by substituting these metallic pieces, which are as suitable as the wood for supporting the weight of the upper woodwork. Lastly; for the purpose of more securely connecting together the upper and lower parts of the recess, they may be strengthened by iron plates. It is evident that the top of the bearing, as also every piece of the upper and lower packings, may be removed, readjusted, and replaced without unshipping any other piece but the bearing itself; and this, when the ship is aground, can be got at from all sides. This bearing may be made of great length, in order not to wear out rapidly. It may be made 25, 30, or even 40 inches long.

III. *The Improved Frame.*

The improved screw with moveable vanes requires to have, in a large ship already built, an opening, of which the length from front to back may not be so extensive as to require any important alteration in the construction of the vessel. So to speak, the opening might be made by just sawing through the dead wood and planks, and this without damaging the hull. The metallic frame previously filled with wood, such as is represented in fig. 2, is then to be put in its place. This frame is made in one piece, and nailed firmly to the dead wood. It is curved into a knee form, and forms a rabbet joint with the ribs of the planking. Its angular section gives it considerable rigidity without requiring it to be of great thickness; at the same time this form of section facilitates the motion of the water. In a ship, while building, the frame should be put in place either before the ribs or at the same time with them, and then filled in with wood. Although this frame, as thus constructed, is very rigid, it may nevertheless be thought farther advisable to secure it by means of metal straps, so as to enable it to resist successfully the enormous pressure attending the caulking of the rabbets. This frame encloses also the recess made for the end bearing. In its cross section this frame is very massive throughout, and of substance sufficiently strong to hold the bearing and stuffing-box.

IV. *The Water Tanks.*

In screw steamers there exist two considerable difficulties with respect to the steam engine machinery, which are not so important in paddle-wheel vessels. One of these is the air pump, and the other the numerous holes which one is obliged to make in the bottom of the vessels. In using the screw it is necessary to drive the steam engine machinery at a more rapid rate than in boats propelled by paddle-wheels. As long as the obstacles which exist in the application of high-pressure engines to ocean navigation are not overcome, there will be difficulties to surmount in order to adapt air pumps to engines working at great speed, especially on board large ships. In fact, the engine should be at the bottom of the hold, especially in ships of war. It is not enough that the air-pump should make a vacuum, as usual, for it must also lift the water about sixteen or nineteen feet, which increases the risk of rupture in the interior of the pumps and in all the tubes. It has been endeavoured to remedy this evil by so arranging matters that the air pumps shall perform two or three times fewer strokes than the engine; but this adds to the complexity of the machinery, and increases the weight and obstruction, because the size of the air pump must be increased in the same proportion, and there must be a corresponding enlargement of the opening by which the water is expelled,—all these changes tending to disturb the equilibrium of the machinery. In short, it has not been found that as good a vacuum would be obtained by this means. In a ship in which the propelling apparatus is only used occasionally, the existence of five or six holes several feet below the line of floatation becomes a source of great inconvenience, especially since any one of them might endanger the safety of the ship. It is true that these holes might be bored only at the line of floatation, and might be made to communicate by tubes with the different parts of the apparatus; but there is still the obstruction and fresh risks of rupture; and, moreover, in ships of war, the machinery would not be out of the reach of shot.

In order to obviate or to lessen these various defects, and facilitate as much as possible the action of the air pump, I propose that within reach of the engines, near to the well pump, there should be placed two sheet iron reservoirs or tanks, each of about 200 cubic feet capacity.

These two reservoirs or tanks are, when the vessel starts, to be filled with portable

water, which will probably serve for the use of the crew before the ship has found it requisite to make use of its auxiliary screw apparatus. One of these tanks may easily be put in communication (by means of a hose) with a moveable watering cock, such as is usually placed in the neighbourhood of the well pumps of ships of war, so as to draw therefrom the entire quantity of cold water necessary for purposes of condensation, and the water may be carried thence to the condenser by a pipe. The other tank or reservoir is put into communication with the air pump, in order to receive the waste hot water. This tank is connected half-way down with a perpendicular pipe placed along the side of the well pump, and through which pipe the lifting action of the air pump will force up water for throwing on to the deck. The upper half of the reservoir is to be filled with air, which will act as a cushion to protect the machinery from shocks. In case of any damage being done, or if it is desired to set part of the crew to work to relieve the air pump, and consequently to increase slightly the power of the steam engine, the water of this tank can be raised from the hold by means of common pumps, which can easily be put into communication with it. If the vessel should leak considerably, the steam can be condensed with the water from the hold, and the water of condensation expelled by the action of the air pump. This is a valuable expedient, which is important in diminishing the risks of damage. The former of these two tanks may furnish water for feeding the boilers, for supplying the ship's fire pump, and for extinguishing cinders. The second tank may be put into communication with the lower part of the boilers, for the extraction of water when saturated with salt. This water will be expelled simultaneously with the water which has served for purposes of condensation. Thus this advantage is hereby gained, that it is not necessary to bore any holes in the bottom of the vessel, which may be stopped up by shellfish or seaweed when the machinery has remained stationary for some time, or which may give rise to leaks. No bursting of pipes need any longer be feared, and all parts of the apparatus may be inspected and repaired during the voyage. The rapid action of the air pump becomes as little dangerous as that of the same pump in paddle-wheel vessels, because all shocks are deadened by the intervention of a very large reservoir of air. The power of pumping water from the hold with the engine is still retained. To obtain all these advantages, it is sufficient to put on board two large tanks, the weight and obstruction of which cannot be objected to, since they serve to hold potable water.

Description of the Engravings.

A is the dead wood; B the wing transom; C stern-post and inner post; D keelson, which is cut away to allow the stuffing-box to pass through. Two ties should be added here, to strengthen this weak part of the ship.

a, a, a, a, outline of the opening to be made in the dead wood of a ship already built. On the part *b, b, b,* which forms the back part of this outline, a small angular piece of wood is placed, in order to facilitate the clearance of the water expelled by the screw.

d, d, d, d is the metal frame, made in one piece. This frame is to be filled-in, as before stated, with wood, before being put in its place, in the case of ships already built; but in ships to be built, the frame, having been first set in its place, should be filled up with wood in proportion as the pieces composing the dead wood are put in their place.

This frame is made angular in its cross section, in order to facilitate the movement of the water, and to obtain the greatest possible strength from the quantity of material employed. This frame is of solid metal throughout the parts surrounding the recess. It forms a rabbet joint throughout its circumference, and can be caulked at right angles.

This frame, which is nailed throughout to the dead wood, may be strengthened by two or four straps, does away with all necessity for any other iron work to compensate for the portion of the dead wood cut away for the passage of the screw.

E the inner shaft, which carries the second pair of the vanes of the screw. This shaft is increased in diameter on the front of the bearing I, in order to compensate for the stuff cut away to form the mortise to receive the wedge, whereby the shaft is enabled to resist the power of torsion of the entire screw. This metal shaft is united at its front end by a coupling to the iron shaft, which continues it on to the engine.

The reaction of the screw in backing the vessel is thrown on the bearing I by means of an increase in diameter of the shaft E. The more important reaction required for the forward course is supposed to be exerted on a point at the end of the front shaft of the engines.

F is a hollow shaft, which carries the first pair of vanes or wings, and is also increased in diameter in front of the bearing I. This shaft is concentric with the preceding, and is separated from it by an annular space about one-fourth of an inch throughout its length, except at the points *e f*, where the shafts come in contact. The space between this shaft and the preceding is filled with concrete palm oil, or any other suitable lubricating substance.

H is a common stuffing-box. It begins at the back of the recess in the aperture made for the screw, where it is fitted with a washer K bedded in the thickness of the frame *d, d, d*, and secured by screws, if it is feared that the stuffing-box may yield towards the front. To prevent the stuffing-box from receding towards the back, there is a projection at C^2, which presses against the front face of the frame. Between the tubular stuffing-box and the shaft F there is an annular space of about half an inch, into which the water enters freely. This tube terminates in front in a collar or neck, to which a cap is bolted. I, bearing on the inner standard of the shaft of the screw. The standard is strongly secured to the keelson, and should be brought as near as possible to the stuffing-box. It is on this bearing that the reaction of the screw in backing is exerted. L L the first pair of vanes or wings attached to the extremity of the shaft F, and secured by keys. The vanes have the degree of thickness indicated by the cross sections at O O. This pair of wings or vanes is, like the other, about 14 feet in diameter, and the pitch of the thread is also about 14 feet. N N, the second pair of vanes or wings fixed on the shaft E with keys, and also further secured by a pin passed through the shaft E. P, Q, R, S, is the end bearing. This bearing should be very long, so as to wear out slowly—say, for example, as represented in the engravings, about 30 inches. It is fixed in such a manner that it may be easily got at to be examined, repaired, or changed.

P is the sliding support, made in one piece of metal, fixed by a dove-tail groove on the lower side of the frame of the recess. This piece, which cannot wear out, is supposed to be placed before the wings or vanes of the screw have been fixed in. Q is the cap of the bearing, which is secured to the support by bolts, as usual; this cap can be unfixed when the wedge T is removed, and it may be either in one piece or composed of two or three parts combined lengthwise; and in either case the portion of the dead wood above the recess is connected by means of iron plates to the portion below it. This cap ends in a large flat part arranged to receive the wedge T.

R lower packing of the bearing. It is divided into pieces sufficiently small to allow of their being passed between the back of the bearing and the first pair of vanes or wings L, so that this bearing may be changed without unfixing anything.

S upper packing of the bearing. It is divided into several pieces, in order that it may be unfixed without meeting any impediment in the fixing of the iron plates before referred to, but which are not shown in the engraving.

T-wedge, which is forcibly driven in, in order to bear the weight which is above the recess on the pieces which are below. The action of this wedge, combined with that of the iron plates before referred to, restores to the whole dead wood as much solidity as if there had been no aperture made for the placing of the bearing. V iron wedge, which fixes the shaft F on the shaft E, so that the pair of vanes L project over the pair N, and on the stern-post, so that these two branches may make, between them, a right angle. Y pinion fixed on the shaft F, by means of which a movement of rotation round the shaft E is given by the crank and endless screw K^2, mounted in the frame J J, so as to place the pair of vanes L in a position of rest or in a position of action.

Z coupling in wrought or cast iron, and in one or more pieces, which connects the shaft E with the iron shaft *m*, which prolongs it on to the engines. The shaft E and the shaft *m* should be adjusted, with respect to one another or to the coupling, in such manner that in the forward course the reaction of the screw may be exerted on the end of the shaft in front of the engines.

Fig. 1 is a longitudinal section through a plan of the stern of the boat, showing the keel, stern-post, wing, transom, dead wood, and screw (the vanes of which are represented as projecting one over the other), the details of the screw-shaft bearing frame, &c.

Fig. 2 represents a section through a transverse plan of the aperture of the screw. The wings or vanes of the screw are here shown in their unfolded state.

Fig. 3 is a plan representing several of the details, especially those of the stuffing-box.

For claims, see *ante*, vol. liii. p. 518.

ON THE MANUFACTURE OF SMALT. BY CHARLES TOMLINSON, ESQ.

(From a Paper read before the Society of Arts.)

This branch of manufacture is altogether foreign; and the chief material for it is almost entirely obtained from two small districts, one in Saxony, on the borders of Bohemia, the other in Norway. To these districts we are mainly indebted for the blue colour so extensively used in painting and varnishing porcelain and earthenware, for tinging crystal, and for enamelling: for imitating opaque and transparent precious

stones, for imparting a magnificent blue to glass, for giving a blue tint to writing-paper and to linen, for the blue figures in paper-hangings, and for various other useful purposes in our arts and manufacture.

Mr. Tomlinson visited the mining district of Saxony, in the autumn of 1847,—a district famous for its mineral riches, and equally famous for the reputed hosts of spirits, gnomes, and *kobolds*, which are said still to watch over the concealed treasures of the district. These presiding genii had long rewarded the miner's toil with rich ores of silver, copper, and lead; but at length, with a caprice not uncommon to their nature, they withheld, or scantily supplied, these valuable gifts, and suffered the poor miner to toil to no purpose; for he brought up little else than a despised ore, which yielded nothing to the smelter but a reddish-brown powder, while it injured his health by its arsenical fumes. The rich ores had been changed into rubbish by the *kobolds*, or goblins of the mine; and the poor miners on this account sought and obtained the intercessions of the Church,—which from that time included in her services a petition for deliverance "from all *kobolds* and spirits which injure the miner."

But in this case, as in many others, the answer to prayer was given in a manner wholly unexpected by the petitioners. The poor miners of Schneeberg, who had suffered most from this transmutation of their rich ores into base *cobalt* (as they called the mineral, after the name of the fiend), were destined to be relieved from their perplexity, and to see the despised cobalt become a source of wealth, far greater than the rich ores whose loss or deterioration they so much deplored.

One Christopher Schurer, a glass-maker at Neudeck, first collected some of this Schneeberg ore, and tried it in his glass-furnace, when he found to his delight that it communicated to glass a beautiful blue colour. This was about the year 1540, or perhaps earlier. Schurer made many trials of the new material, and at length succeeded in making of this blue glass *an enamel colour*, well adapted to the use of the potter. This colour found its way to Nuremburg, and at length to Holland, where it was highly appreciated by the Dutch artists. They sought out the humble glass-maker of Neudeck, and invited him by large promises to reveal his secret. He took up his residence for a time in Magdeburg, and had the ores of Schneeberg conveyed thither for the purposes of his manufacture. But he afterwards returned to Neudeck, and constructed a handmill for grinding his glass to powder, and afterwards another which was driven by water. Meanwhile the Dutch had become expert in the preparation of the colour, so that they obtained from 100s. to 120s. per cwt. for it, while the price in Saxony was only 22s. 6d. per cwt. At a later period, therefore, the Elector of Saxony had to invite the colour-makers of Holland to teach their methods to his people; after which colour-mills rapidly increased in the neighbourhood of the cobalt mines.

Thus for a very long period this beautiful colour continued to be manufactured from a mineral whose composition was unknown. It was not till the year 1733 that the Swedish chemist, Brandt, obtained from this ore the metal which he called *cobalt*, and proved that the colouring matter is the protoxide. In 1780, Bergman confirmed and extended Brandt's results; and in 1800 the subject was taken up by the School of Mines, at Paris, and investigations were also carried on by Thénard and Proust.

Metallic cobalt is a brittle metal, of a reddish-grey colour, which fuses with difficulty; and has a varying specific gravity from 7·7 to 8·7. It is magnetic; its symbol is Co.; and its combining weight 30. It has not been applied to any useful purpose in the arts, and the interest attaching to it is purely scientific. The native combinations of the cobalt are the oxide, and compounds of the metal with iron, nickel, arsenic, and sulphur.

The most important mining centre of Saxony is Freiberg. This interesting town contains the celebrated School of Mines. (*Berg Academie*), to which students repair from all parts of the world for instruction in the art of mining. There are professors of geology and mineralogy; professors both of the practice and the theory of the art of mining; first-rate instruction in surveying, mining, the preparation of the ores, &c.; a museum of minerals, and models of mines and machinery. Among the latter, the hydraulic machinery is excellent, rendering unnecessary, or at least undesirable, the use of the steam engine. The water-power in the mine which Mr. Tomlinson descended was a small brook, brought in an artificial channel a few feet below the surface of the ground, from a distance of several miles, and yet so skilfully distributed as to supply the necessary power both above and below ground.

In the neighbourhood of Freiberg there are upwards of a hundred mines of silver, copper, lead, and cobalt. These can be visited by obtaining a pass or permit, called a *fahrschein*, from the the Bergmeister in Freiberg, the fee for which is applied to the relief of sick or decayed miners. The customs among these simple people are peculiar,

and the names they give to the mines and lodes are interesting. A peculiar rich lode has a German name, which signifies "God's blessing makes us rich;" another, "Trust in God;" a very deep mine (that which Mr. Tomlinson descended) is called "Heaven's path;" another, "Jacob's ladder;" and so on. The miners form a sort of semi-military corps, the superintendents acting as officers. Their salutations differ with the hour of the day and the proceedings of the mine; and they have a good custom of assembling to ask the blessing of God upon their labours before they begin work. Half an hour is employed in this way every day, and in singing the beautiful hymns of the Lutheran Church.

After the fatiguing descent, and still more fatiguing ascent, Mr. Tomlinson witnessed the cupellation of silver on a magnificent scale, and also the machinery for stamping and dressing the ores. The treatment of the ores of cobalt differs from that of the argentiferous galena, &c. In the latter the object is the reduction of the metal; in the former, the oxide alone is required. To obtain this oxide in a state of tolerable purity requires much careful and laborious manipulation, varying somewhat, according to the nature of the ore. The ores of cobalt usually contain cobalt, arsenic, sulphur, iron, bismuth, and nickel. The first process is *picking*, by which stony fragments are removed, and the ores are separated into different qualities; the richest being set aside for roasting, with little or no previous preparation, and those containing nickel being reserved for special treatment. The larger bulk of the picked ore is, however, subjected to the next process, which is *stamping* in a stamp-mill. Here a cam, or tappet-wheel, lifts up a number of pestles of pine wood, shod with lumps of cast iron, and suddenly releasing them, allows them to fall by their own weight upon the ore, which is distributed in chests beneath. The stamp troughs are furnished with a stream of water, which washes out the pounded ore, and carries it down an inclined plane; where the sand and earthy matters, being much lighter than the metallic oxides, are carried farthest by the action of the stream, and are easily separated from the heavy and valuable particles. The ore thus washed is next *roasted* in a reverberatory furnace, provided with chambers for receiving and condensing the arsenic. The condensing tube is upwards of 100 feet in length, or a shorter tube is connected with chambers of several stories, where the arsenic (an important article in commerce) is collected by men wearing a dress fitting tightly in every part, a helmet with goggles for the eyes, and a wet bandage or sponge tied over the mouth and nostrils. They are still further fortified for their dangerous occupation by drinking, not, as our English workmen would be tempted to do, a *dram*, but a glass or two of olive oil. Their food also is regulated, and consists chiefly of vegetables, with abundance of butter. This is the system adopted in Silesia, at Reichenstein and Altenberg, where large quantities of arsenious acid, realgar, and orpiment are manufactured from arsenical pyrites.

In the roasting of cobalt, the ore is wetted and spread over the sole of the reverberatory furnace, in a layer five or six inches deep; it is then cautiously heated for six hours, during which time abundant fumes are produced, consisting chiefly of vapour of water, and arsenious and sulphurous acids; the heat is then increased, and continued for sixteen, eighteen, or twenty-one hours, the ore being disturbed with a rake to bring all parts under the action of the flame and of the air. When the ore becomes red hot, the operation ends. The ore is then withdrawn, and the furnace allowed to cool before a fresh charge is put in. The sand which was separated in the dressing is sometimes mingled in certain proportions with the ore in the roasting; and the product thus obtained is the zaffre or saffre of commerce, a crude product. *Smalt*, on the contrary, is a valuable and carefully-prepared vitreous compound—a rich blue glass, in fact—to be afterwards reduced to powder and elaborated in the manner now to be described. Glass is well known to be a compound of a silica and an alkali, but this compound is not very stable. If we reduce a piece of glass to powder by grinding in a mortar, a considerable quantity of alkali can be washed out; and even by moistening pounded glass with water, a piece of turmeric paper will detect the presence of free alkali. Silica and potash,—both very carefully prepared, calcined, sifted, and preserved from moisture, — are mixed with oxide of cobalt to form smalt, the proportions varying according to the commercial variety of the article required.

The ingredients are intimately mixed in a wooden trough two feet deep, when they are transferred to the melting pots, which are built up in a furnace heated to the proper temperature, each pot being first charged with an inferior blue glass in powder, called *eschel*, the effect of which is to give an interior vitreous lining to the pots. The smalt mixture is poured into the pots by means of iron ladles with long handles, and in about eight hours it fuses, and a vitreous crust is formed on the surface; this is broken through, and the mixture stirred by

means of an iron tool, made red-hot for the purpose. When the pots appear at a white heat, their contents are quite fluid, and the chemical combination of the materials has been effected. This is termed the *schmelzung*, or melting, and thus gives us the derivation of the word *smalts*. The German verb *schmelitzen*, to melt or smelt, and the noun *schmelts*, or *schmalts*, which signifies enamel, naturally lead to the English *smalts*, which is, literally, a product obtained by *melting*.

When the glass attaches itself to the workman's rod, and can be drawn out into threads, it is ready for pouring; but it must first be carefully freed from two impurities, which interfere with the very dark homogeneous blue colour which the glass ought now to present. These are; first, *glass gall* or *sandiver*, which forms as a scum on the surface, and can therefore be skimmed off; and secondly, the metallic impurities of the oxide which sink to the bottom, but are sometimes met with in diffused globules throughout the lower portion of the glass-pot. This sediment is of variable composition, but may contain cobalt, nickel, iron, arsenic, bismuth, and even silver: it is known in commerce by the name of *speiss*.

The pure blue glass is next taken from the glass-pot in iron ladles; and as the object of subsequent processes is to reduce the glass to powder, that object is facilitated by emptying the ladles into vessels of water, the water being constantly renewed. The glass being at a red heat when it first comes in contact with the water, is thus rendered, like Prince Rupert's drops, excessively brittle, granular, and easy to pulverize. When the glass-pot is half empty, the workman examines the contents of his ladle to see if any speiss is there; if so, he manages to separate it from the blue glass by skilful pouring. All the glass-pots are thus emptied before a fresh charge is given to any one of them; for so great is the reduction of temperature in charging three or four pots, that the contents of the others would become solidified, or too pasty to be ladled. The charging of the six pots reduces the furnace to a brownish-red heat, and an hour and a half is required to get it up again to the proper temperature, which is that of an ordinary glass-furnace.

The next process in the manufacture of smalts is, the apparently simple one of reducing the blue glass to powder. But if we try the experiment of grinding to powder a portion of blue glass, we shall find that the substance, which by transmitted light had appeared so beautiful, is reduced in its disintegrated state to a light dingy powder; yet who can doubt that the same amount of colouring matter is present in the powder as in the glass? There are, therefore, difficulties to be overcome in converting a sheet of blue cobalt glass into a powder of an intensely blue colour, and in obtaining all those shades and varieties of blue which are found in our manufactures. The processes are as follow: The blue glass is first crushed in the dry state at a stamping mill; then sifted to the size of ordinary sand; and this sand is afterwards ground in a mill between horizontal granite stones, in quantities varying from 1½ to 2 cwt. at a time. It is wetted with a little water, and the grinding is continued from four to six hours. The powder thus produced is then transferred to large vats full of water, and in the course of a very few minutes a separation of particles takes place in the powder; the heaviest, being those which are richest in cobalt, sink to the bottom: and this deposit constitutes one of the commercial varieties of smalts, known as *azure*, *coarse blue*, or *streublau*.

The water which holds the finer particles of the powdered blue glass in suspension is drawn off into other vats, where it is allowed to subside for three quarters of an hour or more, according to the variety of smalt intended to be produced; this second deposit is called *farbe*, the German word for *colour*. The water drawn off from this second deposit is poured into vats, and allowed to remain for an indefinite time; and its deposit is called *eschel*, or *blue sand*. But the colours thus obtained are all again subjected to the action of water, before they are fit for the market. Each deposit is agitated in tubs abundantly supplied with water, and is again allowed to subside, while any floating impurities are removed with a sieve. The water then drawn off is treated as in the former case, and the various kinds of subsidence form different varieties of colour.

The glass of cobalt appears to be a mixture of the less fusible silicates, in which *cobalt* prevails, and which resists most perfectly the action of the water; and the more fusible silicates, in which *potash* prevails, and which are more susceptible of the action of water. The former silicates constitute the *azure*, or coarse blue; the latter are partially decomposed by water, which subtracts a subsilicate of potash, and leaves a supersilicate of potash in a minutely divided state. *Farbe* owes its tints to the subtraction of potash; *eschel* contains more silica, and less potash and cobalt, than the other varieties.

The beauty of smalt is said to be heightened by what may be called accidental causes; the presence of four or five per cent. of arsenic and arsenious acids; from

six to nine per cent. of phosphoric acid; and minute particles of zinc, tin, antimony, and nitre. On the other hand, it is deteriorated by the presence of nickel, lead, iron beyond ten per cent., bismuth, borax, soda, the alkaline earths, alumina, feldspar, fluor-spar, and sulphur.

The precipitates of smalt are dried into hard masses, which are crushed by mallets, then passed between cylinders, and sifted in fine sieves: the sieves are inclosed within a wooden case, and are set in motion by machinery. The azure is next dried in a hot room, under the tiled floor of which passes a winding flue. A number of shallow wooden troughs are arranged in this hot room, and the smalt is placed therein, and is stirred up from time to time with a rake. When sufficiently dry, it is taken to another room, where it is subjected to a final sifting, and the manufacture is complete. It is then slightly moistened to prevent waste, and packed in small casks containing half a hundred weight each, and marked with the name of the shade.

Such is the manufacture which has been carried on with profit both to the producer and the consumer for upwards of three hundred years; and now after this long period of success, it is a curious fact, that the miner of Saxony is once more threatened with a superfluity of comparatively useless ore. He does not complain now that the rich ores are deteriorated through the malign influence of such evil spirits as *kobolts*; his evil spirits come upon him now-a-days (in the case of smalt, at least,) in the shape of commercial tariffs. According to our new customs duties, cobalt and zaffre can be imported free of duty, but on smalts a duty of 10s. per cwt. is levied. This ten-shilling duty is proving fatal to the manufacture; for a rival colour called *artificial ultramarine*, which is made at Cologne and the small towns on the banks of the Rhine, comes in free, and is rapidly superseding smalt in the market; at least in all those cases where it is not used as an enamel colour. Ultramarine of the genuine sort is the product of the lapis lazuli, a Siberian mineral of great beauty. The finest qualities of this colour are exceedingly costly (Mr. Tomlinson showed a specimen furnished to him by Mr. Newman, valued at twenty guineas an ounce), but the artificial product referred to can be sold at a wholesale price of fifteen pence per pound.

The uses of smalt were then noticed more particularly, and illustrated by numerous specimens of glass, porcelain, encaustic tiles, paper-hangings, &c., in which this substance has been used. The ash produced by the periodical burning of notes at the Bank was shown in the form of a blue vitreous slag; and blue-tinted paper was stated to exhale frequently, on burning, the peculiar odour of arsenious acid, from the presence of arsenic in the smalt. Methods of distinguishing smalt from artificial ultramarine were shown. In the smalt minute portions of silica can be detected by rubbing with the finger, or by exposure, to a good light, and examining with a lens; and these are not to be found in the rival colour. The smalt is wholly unaffected by nitric acid; but a few drops poured on the artificial ultramarine entirely destroys its colour, and the acid, being decomposed, passes off in red fumes of nitrous acid.

AN ARTIFICIAL TOOTH MANUFACTORY.

The *Boston Christian Register* contains a long and very interesting description of a visit to Dr. Morton's Tooth Factory, at Needham, Massachusetts; from which we make the following extract:—

"Pure crystalized quartz is calcined by a moderate heat. When taken from the fire it is thrown immediately into cold water, which breaks the rocks into numberless pieces. The larger pieces are then broken up into smaller ones, and the whole, when reduced to a proper size, put into a mill, which is itself made of quartz. The mill is turned by steam power. Here the pieces of calcined quartz are ground up into a powder very much after the fashion of grinding Indian corn into meal. Next a variety of spar, which is free from all impurities, is ground up in like manner into a fine powder. Artificial teeth are composed of two parts, called the body and enamel. The body of the tooth is made first—the enamel is added last.

"The next step is to mix together nearly equal parts, by weight, of the powdered spar and quartz. This mixture is again ground to a greater fineness. Certain metallic oxides are now added to it, for the purpose of producing an appropriate colour, and water and clay to make it plastic and give it consistence. This mixture resembles soft paste. The paste when thus prepared, is transferred to the hands of females, of whom he saw no less than fifteen engaged in filling moulds with it, or otherwise working upon it. After the paste has been moulded into proper shape, two small platina rivets are inserted near the base of each tooth, for the purpose of fastening it (by the dentist) to a plate in the mouth. They are now transferred to a furnace, where they are 'cured,' as it is technically called; that is, half-baked or hardened. The teeth are now ready to receive the enamel, which is done by women; it consists of spar and quartz, which has

been ground, pulverized, and reduced to the shape of a soft paste or semi-liquid. In this state it is easily spread over the half-baked body of the tooth by means of a delicate brush. When this is accomplished, but one more step is required. The teeth must be subjected to an intense heat, for the purpose of thoroughly baking them. They are put into ovens, lined with platina and heated by a furnace, in which the necessary heat is obtained. The baking process is superintended by a workman, who occasionally removes a tooth to ascertain whether those within have been sufficiently baked. This is indicated by the appearance of the tooth. When they are done, the teeth are placed in jars or boxes ready for use. An experiment which was made, tested to our satisfaction the hardness of these artificial teeth. One of them taken indiscriminately out from a jar full, was driven, without breaking, into a pine board, until it was even with the surface of the wood. The register expressed its satisfaction at the neat, orderly, and intelligent appearance of the females employed in the manufactory. The room in which they labour at their task has a cheerful look which is not often seen."

PERKINS AND SHARPUS'S DOUBLE CONE SMOKE ELEVATOR.

(Registered under the Act for the Protection of Articles of Utility. Messrs. Perkins and Sharpus, of Bell-court, Cannon-street, City, Proprietors.)

Fig. 1.

Fig. 2.

Fig. 1 is an external elevation, and fig. 2, a vertical section of this elevator. AA is the body, or stalk, which is of a cylindrical form, so that it may be

readily fitted either upon the base B, or upon a commom chimney-pot. CC is a double cone termination to the body A, the upper portion of which causes the wind to be directed upwards, and produces an ascending current in the chimney. D is a double cone, which is suspended from a bridge E, and which occupies the interior of the double conical termination, CC, so as to prevent effectually any downward current.

THE PROTECTION OF INVENTIONS ACT, 1851.

Whereas it is expedient that such protection as hereinafter mentioned should be afforded to persons desirous of exhibiting new Inventions in the Exhibition of the Works of Industry of all Nations in one thousand eight hundred and fifty-one; Be it therefore enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the lords spiritual and temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

I. Any new invention for which Letters Patent might lawfully be granted may at any time during the year one thousand eight hundred and fifty-one, but not afterwards, be publicly exhibited in any place previously certified by the Lords of the Committee of Privy Council for Trade and Foreign Plantations to be a place of exhibition within the meaning of the Designs Act, 1850, without prejudice to the validity of any Letters Patent to be thereafter, during the term of the provisional registration herein-after mentioned, granted for such invention to the true and first inventor thereof: provided always, that such invention have previously to such public exhibition thereof been provisionally registered in manner hereinafter mentioned; and provided also, that the same be not otherwise publicly exhibited or used by or with the consent of the inventor prior to the granting of any such Letters Patent as aforesaid, except as hereinafter mentioned: provided also, that no sale or transfer, or contract for sale or transfer, of the right to or benefit of any invention so provisionally registered, or of the rights acquired under this Act, or to be acquired under any Letters Patent to be granted for such invention, shall be deemed a use of such invention; and the publication of any account or description of such invention in any catalogue, paper, newspaper, periodical, or otherwise shall not affect the validity of any Letters Patent to be during such term granted as aforesaid.

II. The public trial or exhibition of any such invention as aforesaid (being an invention for purposes of agriculture or horticulture), which shall be certified by the Lords of the said Committee to have taken place under the direction of the Commissioners for the Exhibition of 1851 for the purposes connected with the Exhibition thereof, in such place of public exhibition as aforesaid, whether such trial or exhibition take place before or after the passing of this Act, shall not prevent the provisional registration of such invention under this Act, nor prejudice or affect the validity of any Letters Patent to be granted for such invention during such term as aforesaid.

III. Her Majesty's Attorney-General, or such person or persons as he may from time to time appoint to issue certificates under this Act, on being furnished with a description in writing, signed by or on behalf of the person claiming to be the true and first inventor within this realm of any new invention intended to be exhibited in such place of public exhibition as aforesaid, and on being satisfied that such invention is proper to be so exhibited, and that the description in writing so furnished describes the nature of the said invention so intended to be exhibited, and in what manner the same is to be performed, shall give a certificate in writing, under the hand or hands of such Attorney-General or the person or persons appointed as aforesaid, for the provisional registration of such invention.

IV. The registrar of designs acting under the Designs Act, 1850, upon receiving such certificate, and being furnished with the name and place of address of the person by or on whose behalf the registration is desired, shall register such certificate, name, and place of address, and the invention to which any certificate so registered relates shall be deemed to be provisionally registered, and the registration thereof shall continue in force for the term of one year from the time of the same being so registered, and the registrar shall certify, under his hand and seal, that such invention has been provisionally registered, and the date of such registration, and the name and place of address of the person by or on whose behalf the registration was effected: provided always, that if any invention so provisionally registered be not actually exhibited in such place of public exhibition as aforesaid, or if the same invention be in use by others at the time of the said registration, or if the person by or on whose behalf the said registration has been effected be not the first and true inventor thereof, such registration shall be absolutely void.

V. The description in writing of any in-

vention so provisionally registered shall be preserved in such manner and subject to such regulations as the Attorney-General shall direct, and any invention so provisionally registered, and exhibited at such place of public exhibition as aforesaid, shall have the words "Provisionally Registered" marked thereon or attached thereto, with the date of the said registration.

VI. Such provisional registration as aforesaid shall during the term thereof confer on the inventor of such invention, with respect thereto, all the protection against piracy and other benefits which by the Designs Act, 1850, are conferred upon the proprietors of designs provisionally registered thereunder with respect to such designs; and so long as such provisional registration continues in force the penalties and provisions of the Designs Act, 1842, for preventing the piracy of designs shall extend to the acts, matters, and things next herein-after mentioned, as fully and effectually as if those penalties and provisions had been re-enacted in this Act, and expressly extended to such acts, matters, and things; that is to say, to the making, using, exercising, or vending the invention so provisionally registered, to the practising the same or any part thereof, to the counterfeiting, imitating, or resembling the same, to the making additions thereto or substraction from the same, without the consent in writing of the person by or on whose behalf the said invention was so provisionally registered.

VII. All Letters Patent to be during the term of any such provisional registration granted in respect to any invention so provisionally registered shall, notwithstanding the registration thereof, and notwithstanding the exhibition thereof in such place of public exhibition or otherwise as aforesaid, be of the same validity as if such invention had not been so registered or exhibited; and it shall be lawful for the Lord High Chancellor, if he think fit, on the grant of any Letters Patent to any inventor in respect of any invention provisionally registered under this Act, to cause such Letters Patent to be sealed as of the day of such provisional registration, and to bear date the day of such provisional registration, the Act of the eighteenth year of King *Henry* the Sixth or any other Act notwithstanding.

VIII. Notwithstanding anything contained in the Designs Act, 1850, and the two Acts therein referred to, and called the Designs Act, 1842, and the Designs Act, 1843, the protection intended to be by those Acts extended to the proprietors of new and original designs shall be extended to the proprietors of all new and original designs which shall be provisionally registered and exhibited in such place of public exhibition as aforesaid, notwithstanding that such designs may have been previously published or applied elsewhere than in the United Kingdom of *Great Britain* and *Ireland*; provided that such design or any article to which the same has been applied have not been publicly sold or exposed for sale previously to such exhibition thereof as aforesaid.

IX. All the provisions of the Designs Act, 1850, and the provisions incorporated therewith, relating or applicable to the designs to be provisionally registered thereunder, or to the proprietors of such designs, except the provision for extending the term of any such provisional registration, shall, so far as the same are not repugnant to or inconsistent with the provisions of this Act, apply to the inventions to be provisionally registered under this Act, and to the inventors thereof; and the said Designs Act and this Act shall be constructed together as one Act.

X. This Act may be cited as The Protection of Inventions Act, 1850

PROFESSOR PAGE'S ELECTRO-MAGNETIC ENGINE.

Professor Page, of Washington, to whom the Government of the United States have made a considerable grant of money to defray the expenses of a series of experiments in which he has been for a long time engaged to test the practical value of electro-magnetism as a moving power, thus refers, in a letter to the *Scientific American*, dated March 13th, to a rumour that his labours had "ended in no solid benefit to science:"—"From the cordial manifestations received from the friends of science for what I have *thus* far done (13th March, 1851), I feel quite satisfied with the experiments, and I have only to add that they are still in prosecution."

A MOUNTAIN OF MAGNESIA IN CALIFORNIA.

On Pitch (or Pitt) River, the principal affluent of the Sacramento, which flows through a charming valley, and about five days' journey from Goose Lake, there is a hill of pure carbonate of magnesia, 100 feet high. Much of it is perfectly white, while some is more or less discoloured with iron, as if a painter had been striving to give effect by a colouring of light and shade. Large masses were easily detached, which, rolling down into the river that washed its base, floated off as light and buoyant as cork,

until it became saturated with water. A thousand wagons could be loaded in a very short time, and there is enough to supply the whole world. For three days' travel below, the soil seems to be impregnated with it, and the banks of the river formed of it.—*Scientific American.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING APRIL 16, 1851.

JAMES HAMILTON BROWNE, of the Reform Club, Pall-mall, esquire. *For improvements in the separation and disinfection of fecal matters, and in the apparatus employed therein.* (A communication.) Patent dated October 10, 1850.

This invention consists; *first,* in certain disinfecting agents. And, *second,* in the separation of the liquid from the solid matters contained in cesspools, &c., and in the filtration and clarification of such liquid matters, while the solid matters are thereby rendered applicable as manure.

The chemical disinfecting agents hitherto employed are very inefficient, and do not fulfil the desired object; for instance, the sulphate of peroxide of iron has been recommended as being a suitable agent for counteracting the disengagement of free sulphuretted hydrogen; now, by the use of this salt, the very evil sought to be remedied is rather increased, for in consequence of its acid nature, disengagement of large quantities of sulphuretted hydrogen and carbonic acid gases takes place, which causes a great deal of froth and scum to accumulate on the top of the matters acted on. Now the agents and processes which I use are as follows:—1. I combine with or neutralize phosphuretted hydrogen gases by means of the impure binoxide of tin, which may be purchased at a low price. 2. Or I employ the subsulphate of peroxide of iron, represented by the formula $SO^3 Fe^2 O^3 + 6 HO$, which does not contain an excess of acid, but on the contrary, being basic, as well as peroxidized, completely destroys the sulphuretted and phosphuretted hydrogen gases, and prevents froth and scum, the presence of which indicates a want of success in disinfecting operations; it also neutralizes the carbonate and hydrosulphate (sulphydrate) of ammonia, which are the only other gases arising from cesspools and such like receptacles.

3. Any neutral metallic salt may also be used to fix any gases other than free sulphuretted and phosphuretted hydrogen, and either the binoxide of tin or the subsulphate of peroxide of iron may be subsequently introduced to decompose the two gases just mentioned (carbonate and hydrosulphate of ammonia).

4. The saturation or neutralization of the before-named metallic salts may also be effected by the use of the ammoniacal water from gas-works.

5. By increasing the proportion of ammoniacal gas-water, the non-permanent carbonates and hydrated oxides of iron, of zinc, &c., would be precipitated, and thus a good disinfectant may also be obtained. A solid disinfecting agent, or one in a state of paste, may be made by mixing either the subsulphate of iron, or stannic acid, or oxichloride of tin, with some cheap oleaginous matter; three or four thousandth parts of this paste would be sufficient to neutralize or fix the fetid gases contained in the fecal matters.

6. Under the following circumstances the chloride of calcium (a residuum, now lost, resulting from the manufacture of bone gelatine) makes a good disinfectant, all excess of acid being neutralized either by lime or by ammoniacal gas liquor; the metallic salt is then to be added, when, by double decomposition, are produced sulphate of lime in a very divided state (which will fix the ammonia of the liquids) and neutral protochloride of iron very economically. Besides, by the combination of these substances with the chloride of calcium, a deposit of phosphate of lime takes place, which increases to a great extent the richness of the matters operated on, when converted into manure.

7. The influence of oleaginous matters in the instantaneous disinfection of putrid matters, &c., has not been sufficiently studied, nor has the action of fatty bodies upon the sulphuretted hydrogen; a gas so much like, from its composition and chemical nature, if not from its physical qualities, to the carburets of hydrogen. For instance, it has always been supposed that common oil only tended to cover the surface of the matters, and thus as it were to imprison those gases so unhealthy and unpleasant to the smell; this is not going far enough, and it will be shown that the results produced have not been properly understood. Convinced of the highly disinfecting powers possessed by the carburets of hydrogen, the inventor has endeavoured to discover the means of turning their use to good account; a little reflection will show that oil and fatty matters have hitherto been used without any regard to economy; in fact, people have gone no further in many cases than to throw a few quarts of oil over the matters in cesspools, &c., a proceeding attended with the following disadvantages:—First, the difference of specific gravity prevents a mixture

taking place; and, second, the oil only covers the surface of the matters, and does not act at all on the lower part, therefore its action is incomplete. To overcome these disadvantages; first, the difference of specific gravity must be adjusted; and, second, the surface for the oily matters to act upon must be considerably increased.

The inventor makes an artificial disinfecting fluid, holding an oily substance in solution, and very finely divided, for which purpose some hundredth parts of oil or fatty substance are mixed with water, which, to facilitate union, should be made slightly alkaline, either by potash, soda, or ammoniacal gas water, &c. After the fatty substances and water have been intimately mixed, a white, opalescent, and lactiform fluid will be produced; according to the quantity of oil or fat used will be the strength of the disinfecting liquor, therefore it is unnecessary to give an exact scale of proportions. In order the better to adjust the difference of specific gravity, it is preferable to use the lactiform fluid in combination with one of the salt solutions before described. The metallic salts will, of course, act, and wherever they penetrate, there the oily matter will go with them. If desirable to increase the density of the lactiform liquid without using the metallic salt, which causes a change in the colour and appearance of the fecal matters, it is only necessary to substitute for the metallic salt a saline solution or chloride of calcium (residuum from the manufacture of gelatine from bones), which, being acid, requires to be first carefully neutralized. The chloride of calcium resulting from the manufacture of artificial soda would also answer the same purpose. The inventor also uses in some cases, together with the lactiform liquid, certain remains left from the manufacture of stearine, the liquid remaining from the washing and cleaning of wools, and the remains from the purification of oils, known as oil finings (*fèces d'huile*). This liquid may be used either alone or together with metallic or non-metallic salts.

8. Organic matters, while fermenting, are in a state of continual movement, resulting from the transformation of a portion of the solids and gases. In the transformation there is an absorption of heat, without which, therefore, neither fermentation nor putrefaction can take place. This motion of particles, due to fermentation and to the gases resulting therefrom, having a tendency to pass off, is more visible when the fermentable matters contain a quantity of liquid.

The inventor has discovered certain means of arresting this fermentation, and of hastening the precipitation of the matters held in suspension, so that they may be more readily separated. First, fermentation is arrested by the introduction of one or other of the disinfecting agents before described (other known disinfectants may also be employed for this purpose); and second, the precipitation and separation of the matters so treated are facilitated by the disinfectants before described. They generally produce a metallic sulphate, which, by its superior gravity, causes the more rapid descent of the organic matters held in suspension; which, in some cases, is effected in a few days, but more generally in a few hours. The liquids are then drawn off by any suitable apparatus, and if they cannot be dispersed over the fields, may be thrown away, while the remaining portions at the bottom of the receptacle are taken out to be immediately converted into inodorous manure.

Should the liquid extracted not have been allowed sufficient time to settle, and before being thrown away or placed into reservoirs, it is passed through a filter, preference being given to a filter formed of carbonaceous substances.

To the pipe conveying the liquid into the filter, or that which takes it from the filter, a small tube communicating with the vessel on a higher level, and containing the disinfecting liquor, is connected, so that should the disinfectant not have penetrated everywhere, and have rendered the disinfection complete, it may thus be made perfect before the liquid is thrown away.

More rapid and perfect clarification or decantation may be effected by means of any compound of alumina, particularly the double sulphate of alumina and of potash, or the impure sulphate of alumina.

9. The patentee finally describes an apparatus for disinfecting matters during their passage through the pipes, by which they are withdrawn from the depository.

By following the processes, one or other of them herein described, the after manufacture into manure is much more economical, much more rapid, and there will be much less loss of ammoniacal substances than by any other means hitherto adopted.

A mixture with some dry carbonaceous powder would ensure a rapid conversion (from fifteen days in summer to one month in winter) of fecal matters into a powdery and permanently inodorous substance.

Claims.—1. The separating of the liquid from the solid parts of fecal and putrid matters, and the disinfecting of fecal and putrid matters by means of any of the metallic salts before described, whether em-

ployed by themselves or in conjunction with the lactiform fluid before described.

2. The lactiform fluid before described, for the purpose of disinfecting fecal and putrid matters. And

3. The disinfecting of fecal matters while being withdrawn from a cesspool or other receptacle, by means of the apparatus before described.

ADOLPH FREDERICK GURLT, of Manchester, gentleman. *For an improved method of extracting silver from argentiferous minerals.* Patent dated October 10, 1850.

Before proceeding to a description of his improvements, and in order to exhibit more clearly their distinctive peculiarities, the patentee alludes briefly to the principal methods hitherto employed to effect the same object. These are—

1. The eliquation process in which the argentiferous mineral is melted with lead, or a suitable combination of lead; the silver combines with the lead, owing to its great affinity for that metal, and is afterwards separated by cupellation, as is well understood.

2. The European method of amalgamation, in which a chloride of silver is formed by mixing common salt in a reverberatory furnace with the calcined ore or regulus, which chloride is then reduced to the metallic state by metallic iron, and dissolved in quicksilver, thus forming an amalgam, which is separated from the ore or regulus by washing processes, and afterwards deprived of its mercury by distillation, leaving the silver in a metallic state.

3. The American amalgamation process, in which calcined copper ore (magistral) and common salt are mixed with the material from which silver is to be extracted, and water added in sufficient quantity to produce a thick pasty mass. The chloride of silver thus formed is reduced to the metallic state by iron, and dissolved in mercury, producing an amalgam which is subsequently treated in the same manner as that obtained by the European method of procedure.

4. A method in which a chloride of silver is formed in a reverberatory furnace, as in the European method, dissolved in a hot concentrated solution of common salt, hyposulphite of soda, or other suitable agent capable of dissolving the chloride of silver, and separated from the insoluble matters by filtration, metallic silver being obtained by means of any suitable metal.

5. Another method in which all the sulphuret of silver contained in the ore is converted by calcination into a sulphate, which is dissolved in boiling water, and metallic silver precipitated by the ordinary means.

The patentee's method differs from all of these, and consists in subjecting the ore containing sulphuret of silver to the direct action of a concentrated solution of common salt, or its chemical substitutes, such as chloride of potassium, ammonium, &c., in combination with chloride of copper, iron, zinc, &c., by which the sulphuret of silver will be converted into chloride of silver, and dissolved in its nascent state (any native chloride, *e.g.* horn silver—being also dissolved at the same time), from which solution metallic silver may be obtained by means of suitable metals.

In carrying the invention into effect, a mixture is prepared containing 100 parts of a concentrated solution of alkaline or earthy chloride to 10 parts of the metallic chloride, and heat applied till the temperature of the solution is raised to about 200° Fahr., in which state it is fit for use. The argentiferous substance to be operated on, whether ore of copper, iron, zinc, &c., or regulus, is to be reduced to a fine powder, in order to facilitate the lixiviating process. When the gangue of the ore consists of carbonates or oxides of lime, magnesium, barium, strontium, &c., which would act prejudiciallyon the metallic chlorides, and convert them into hydrates or oxides, it must be smelted before lixiviation, so as to reduce the noxious matters to slag and the metals to regulus. Should it, however, not be desirable in other respects to perform this operation, the ore must be immersed in dilute muriatic or sulphuric acid, which will, in a great measure, produce an analogous effect. The operation of lixiviation is effected in revolving casks, such as are used in amalgamation works. These ar charged according to their size with the solution and argentiferous substance, the former in the proportion of three times the volume of the latter, and both heated to about 200° Fahr. previous to their introduction, except where means exist of applying steam or other heat during the process. The cask is then set in agitation, and at the expiration of a stated time, varying with the quantity of ore and the amount of silver contained in it, the solution is tapped off, a fresh supply introduced, and this operation repeated till all the silver is supposed to be extracted. For a charge of 5 cwts. of ore the average time occupied is twelve hours, the solution being changed three times during this period. On its withdrawal from the cask, the ore or regulus is to be washed in some of the solution to remove any chloride of silver that might be adhering to it, and which would otherwise be lost. In order to obtain metallic silver

from the solution holding the chloride in suspension, the patentee prefers to employ the metal whose chloride has been used in making the solution, as in this case a new chloride will be produced equal to the quantity of silver precipitated, and the liquor may be then used in a succeeding operation. He also employs in making the solution a chloride of that metal which predominates in the ore. When the ore contains, in addition to the sulphuret and chloride, metallic silver, but not in sufficient quantity to be worth mechanical extraction, it is recommended to smelt the ore previous to lixiviation, so as to reduce all the silver contained in it to the state of a sulphuret. The chlorides which the patentee prefers as being the cheapest, are those of sodium (common salt), and iron; he employs also in addition to those above enumerated the chloride of lime.

Claim.—The use of a combined solution of the chlorides of potassium, sodium, ammonium, &c., and the chlorides of iron, copper, zinc, &c., for the purpose of extracting silver from argentiferous minerals.

WILLIAM EDWARD NEWTON, of Chancery-lane, engineer. *For improvements in manufacturing yarns.* (A communication.) Patent dated October 10, 1850.

The object of this invention is to spin yarns or threads continuously from rovings composed wholly or partially of wool, or of any other long fibres, and the improvements claimed are:

1. Condensing the rovings during the process of being stretched between two or more sets of drawing rollers by means of an endless band (composed of list, felt, or buff leather), which is passed around guide-rollers in immediate proximity to the lower drawing-rollers and revolves with its inner surfaces in contact, imparting thereby a counter-twist to the rovings, which has the effect of condensing the fibres and ensuring evenness and regularity in the stretching process.

2. Combining with the condensing and stretching apparatus flyers for spinning the rovings immediately as they are delivered from the last set of drawing rollers. When the threads are required to be even and regular, and the fibres well laid in, the flyers are caused to revolve in the same direction as the condensing band, but in the opposite direction, when the threads are to be rough and wiry, and have the fibres projecting. The spinning apparatus described as being employed, is that known as the ring-groove spinner, but any other flyer which is adapted for spinning wool or long fibre is equally suitable for the purpose.

WILLIAM WOOD, of Over Darwin, carpet manufacturer. *For improvements in the manufacture of carpets and other fabrics.* Patent dated October 10, 1850.

Claims.—1. Weaving terry fabrics in power looms, in which the warps are upright and the reeds horizontal, and introducing and withdrawing the wires in such a manner as to take advantage of the horizontal position of the reeds.

2. The method of introducing and withdrawing the wires in weaving terry fabrics by power.

3. A method of imparting motion to the crank of power-looms by means of a cog-wheel working into a pinion.

4. Printing carpets by composing colours in patterns, and fixing them by steam. The patentee in this case makes the colour into a paste with gelatine or other similar substance, which is then rolled into sheets: each sheet is cut into strips of a square section, which, with others of various cutters, are made into blocks, according to any desired pattern. In printing from colour prepared in this manner, a thin sheet is cut off from the gelatine block, and laid on the fabric, which is then enclosed in a chamber, where steam is applied to melt the gelatine and fix the colours.

CHARLES BURY, of Salford, manager. *For certain improvements in machinery or apparatus for preparing, spinning, doubling, or twisting silk waste, cotton, wool, flax, or other fibrous substances.* Patent dated October 10, 1850.

Claims.—1. With respect to slubbing and roving bobbins and braids, the employment of bobbins having their ends bored out larger, or of increased diameter internally, for the purpose of admitting the boss of the flyer and the boss of the braid or driving pinion. Also, a peculiar construction of braid, which, having its boss enclosed within the bobbin, and its driving cogs or teeth below the top of the spindle bolster, permits the bolster to be got up nearer to the top of the spindle without losing the present advantage of the braid revolving on a running spindle.

2. In the doubling machine, the methods described, or any modification thereof for causing the breakage or absence of a thread at the front or the back of the delivering rollers, or the breakage or slackening of the spindle band to stop simultaneously the revolution of the upper and lower corresponding delivering rollers and spindle.

3. A method of preventing waste in the roving frame and throstle by causing the absence or breakage of a roving or thread at the front of the drawing rollers, to stop the corresponding drawing rollers except the front pair.

Charles Bury, of Salford, manager. *For certain improvements in machinery or apparatus for cleaning, spinning, doubling, and throwing raw silk.* Patent dated April 10, 1850.

Claims.—1. A peculiar arrangement and construction of the "cleaners" employed for removing any waste, dirt, &c., from the silk previous to its undergoing the process of doubling; especially the application of a spring, whether formed of India rubber or any other suitable elastic material, to retain the cleaning blades in proximity, and, at the same time, allow of their ready separation when the dirt and refuse is to be removed, and insure their self-readjustment when so cleared.

2. The application to the doubling frame of a roller or rollers for imparting an extra amount of tension to the coarser threads, in order to prevent their over-riding the finer ones in the process of doubling, so as to ensure the greater regularity and evenness of finish.

3. An arrangement of apparatus shown as applied to the silk-spinning mill, or any mere modification thereof, for breaking or cutting the threads whenever the spindle driving-band becomes too slack or breaks, a contingency of no unfrequent occurrence, and attributable mainly to the very high degree of speed at which the spindles are required to revolve.

4. The combination in one machine of apparatus for performing the hitherto distinct operations of doubling and throwing, and especially an arrangement whereby the breakage of a thread, either at the front or back of the delivering rollers, or the slackening or breakage of a spindle-band is caused to raise both the upper and lower corresponding rollers, and apply a brake to the corresponding spindle.

William Francis Fernihough, of London, engineer. *For improvements in locomotive and other steam-engines, and improvements in obtaining motive power.* Patent dated October 10, 1850.

The improvements claimed as relating to "locomotive and other steam-engines" comprehend,

1. A method of warming the feed-water by causing it to pass through a vessel in which a partial vacuum is formed by the action of the pump, so that a portion of the waste steam is drawn from the exhaust-pipe into the vessel, and condensed in the water.

2. The application of a revolving valve to the blast-pipe of engines, in which the waste steam is employed to produce a blast in the chimney, in such a manner that the steam is allowed to escape during a portion of the stroke, the expansion of the steam at the conclusion of the stroke being employed to produce the blast. The object of this arrangement is to relieve the piston from the pressure of the steam during the back stroke.

The improvements claimed under that part of the invention which relates to "obtaining motive power," have reference, 1. To a method of applying the products of combustion of a close stove in combination with steam produced therein, or introduced by a jet, or with air introduced by a peculiar construction of blower to work an impulsive rotary engine. The steam and products of combustion enter the casing of the engine by one or more jets tangentially to its circumference, and pass off as near as convenient to the centre or axis of the casing. The load of engine is to be so proportioned, that the centrifugal pressure of the aëriform products in the casing shall be equal to about half of that in the close furnace. The blower for introducing air into the close furnace is worked by a cord from the spindle of the rotary engine, or may be fixed on the same axis.

2. To a method of applying the pressure of hot aëriform products exerted on the interior of an apparatus constructed on the principle of a gasometer chamber, to produce a rising and falling motion, which actuates a crank through the medium of a piston-rod attached to the top of the gasometer. The exit valve of this apparatus is sealed by the affusion of water.

John Scott Russell, of Great George-street, Westminster, engineer. *For improvements in the construction of ships or vessels propelled by paddle-wheels, with a view to better arming the same.* Patent dated October 10, 1850.

In ships or vessels propelled by paddle-wheels, as usually constructed, the paddle-boxes project from the sides, and have at each end, or fore and aft, platforms or projections. These are in some cases merely overhanging stages—in others, the sides of the ship at each end of the paddle-boxes are sponsoned out, and the platforms then constitute a portion of the deck, whilst occasionally the two modes of construction are found combined. The additional spaces obtained by the platforms are in many instances wholly or partially occupied by deck houses, and the bulwarks either follow the contour or outline of the deck, bending off and including the platforms, or else they follow a line which would leave the platform on the outside of the bulwarks. Now the object of the patentee is to take advantage of the

space afforded by these platforms for mounting, working, and pointing guns, so as to admit of their being fired in a line approaching more nearly to parallelism with the line of keel than has been hitherto practicable with guns placed in or about the middle of the vessel. To attain this end, it is necessary that the bulwarks should include the platforms, from which the deck-houses would have to be removed in vessels altered according to this invention, whilst in building new ones, they would be altogether dispensed with. The angle which it is preferred the platforms should make with the deck, is 45°, or thereabouts; but this may be varied, and they may even be made so bluff as to admit of the lines of fire of the guns on opposite sides of the vessel intersecting each other a short distance in advance of the bow or stern. The platforms may be supported on beams similar to paddle beams, or the sides of the ship may be sponsoned out in order to obtain the necessary degree of solidity; but in all cases they should be so constructed as to be fully capable of sustaining the weight and pressure of the guns to be there mounted, and so as to be on exactly the same level as the deck, to admit of the slides and carriages being readily moved. The bulwarks are to be provided with ports and fittings adapted to the description of guns intended to be placed on the platforms. Instead of making the bulwarks of the platforms fixtures, they may be constructed so as to be capable of being moved inboard when the guns are not in use.

Claim.—Constructing those parts of ships or vessels propelled by paddle-wheels, which consists of the platforms or projections fore and aft of each paddle-wheel box in such manner that advantage may be taken of those spaces for placing and working guns thereon, and so that the line of fire of such guns may be more in a line of parallelism to the keel than has been hitherto the case with guns mounted at the middle of the vessels.

ROBERT BEART, of Godmanchester. *For improvements in the manufacture of bricks and tiles.* Patent dated October 10, 1850.

1. Mr Beart's improvements relate to the apparatus employed for moulding perforated bricks, in which the perforations are produced by piercers arranged in rows. The stems of the piercers have been hitherto of equal length, and attached to bars extending across the moulding apparatus in the same plane. It is now proposed to make the stems of the middle row of piercers (where three rows are employed) longer than those of the other two rows, so as to consolidate the brick more effectually at or about its centre, at which part generally the structure has been to a certain extent imperfect.

2. A peculiar construction of furnace or oven for baking bricks, &c., and of apparatus in connection therewith, for facilitating the introduction and removal of the frames carrying the bricks, &c., into and from the oven, is next described. The products of combustion and the heat from a fire-place first rise into a chamber, from which they descend into reticulated flues or arches constructed of perforated bricks, and again pass upward to the baking chambers or ovens. A quantity of gravel and fine sand is laid on the top of the flues, through which the heat has to ascend before entering the baking chambers. The bearers for receiving the frames, on which are laid the articles to be baked, are provided with rollers for facilitating the introduction and removal of the frames into and from the chambers; and, with the same object, the floor of the oven is also slightly inclined.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Henry John Betjemann, of Upper Ashby-street, Northampton-square, Middlesex, for improvements in connecting parts of bedsteads and other frames, and in machinery employed therein. April 15; six months.

Frederick William East, of the firm of Thomas East and Son, Bermondsey, leather-dressers, for improvements in dressing, embossing, and ornamenting leather. April 15; six months.

Benson Stones, of Warwick-street, Golden-square, Middlesex, for improvements in the use and treatment of peat and its products, and other carbonaceous matters; and also for apparatus applicable to such and other chemical purposes. April 15; six months.

Herman Schroder, of Bristol, gentleman, for improvements in manufacturing and refining sugar. April 15; six months.

Antoine Victor Coutant, of Paris, France, ironmaster, for an improved mode of partially hardening iron for various purposes. April 15; six months.

Thomas Greaves Barlow, of Bucklersbury, London, civil and consulting gas engineer, and Samuel Gore, of Park-road, Old Kent-road, engineer, for improvements in the treatment of certain substances used in the production of gas for giving light and heat, and of some of the products of the said substances, as also in the apparatus employed in the manufacture of such gas, and in discharging and giving motion to gas. April 15; six months.

Charles Hardy, of Low Moor, York, engineer, for certain improvements in the manufacture of scythes. April 15; six months.

Robert Newell, of New York, in the United States of America, lock manufacturer, and a citizen of the said States, for certain new and useful improvements in the construction of locks. April 15; six months.

Frederick Puckridge, of Kingsland-place, Middlesex, merchant, for improvements in the preparation or manufacture of materials or fabrics suitable for ornamenting furniture and other articles. April 17; six months.

Thomas Keely, of Nottingham, manufacturer,

and William Wilkinson, of the same place, frame-work knitter, for improvements in machinery for manufacturing textile and woven fabrics, and other articles composed of fibrous or filamentous materials; also for improvements in the said fabrics and articles. April 17; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
April 10	2768	G. Cooper	Sheffield	The Venetian chimney top.
,,	2769	R. Dark	Burlington Arcade	Collar fastener.
,,	2770	J. Wilson and Sons	Wigmore-street, London	Manifold revolving table top.
,,	2771	H. Martin and J. Smethurst	Hyde, Chester	Appparatus for planing the seatings and faces for slide-valves of steam-engines.
,,	2772	C. Robinson	Greenland - place, Brunswick - square	Telescopic military bedstead.
11	2773	C. Hart	Wantage, Berks	Universal mill.
12	2774	W. Palmer	Brighton	Perforated ventilator (window).
,,	2775	B. Poulson and Co.	Quadrant, Regent-street	Par dessus and Cantab walking coats.
,,	2776	T. Whimster	North Port, Perth	Improvements in the wet gas-meter.
15	2777	H., I., and D. Nicoll	Regent-street	Coat.
,,	2778	J. Nasmyth	Patricroft, Lancashire	Safety-valve for boilers and generators.
,,	2779	Ainge and Aldred	Oxford-street	Telescope landing handle for fishing.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

April 10	149	T. Hodges	Oxford-street	The Demopodeion.
,,	150	J. E. Boyd	Lower Thames-street	Double-action or self-adjusting scythe.
,,	151	W. Hughes	Manchester	Typograph for the blind.
,,	152	M. Roch	South-street, Finsbury	Letter envelope.
,,	153	M. Roch	South-street, Finsbury	Letter envelope.
,,	154	E. Jackson	Stockwell	Measuring telescope.
11	155	E. Huxtable	Hinton, near Chippenham	Floating wheel.
,,	156	W. H. Dupré	Jersey	Wind guard.
12	157	H. Bell	Millbank	Balloon valve.
,,	158	H. Stoy	Lambeth	Railway break or stop.
,,	159	W. and J. Harcourt	Birmingham	The Vesta union vase.
,,	160	W. N. Crips and W. Dugard, Jun.	Hockley-hill; Birmingham	Railway tender and carriage.
,,	161	Paul and Eves	Birmingham	Metallic fitting for lasts and boot trees.
14	162	W. T. Monzani	Bermondsey	Folding tents.
15	163	J. Fiddler and J. Ramsbottom	Derbyshire	Water meter.
,,	164	J. Rigmaiden, Lieutenant R.N.	Regent's-park	Lanyard plates for setting up standing rigging.

CONTENTS OF THIS NUMBER.

Malo's Patent Improvements in Screw Propelling.—Specification.—(*with engravings*) 301
On the Manufacture of Smalt. By Charles Tomlinson, Esq. 306
An Artificial Tooth Manufactory 310
Description of Perkins and Sharpus's Double Cone Smoke Elevator—(*with engravings*)... 311
The Protection of Inventions Act 312
Professor Page's Electro-Magnetic Engine 313
A Mountain of Magnesia in California 313
Specifications of English Patents Enrolled during the Week:—
Browne ......Disinfection 314
Gurlt ......Extracting Silver 316
Newton ......Yarns 317
Wood ......Carpets, &c. 317
Bury ......Spinning, &c. 317
Bury ......Doubling & Throwing Silk 318
Fernihough ......Steam Engine 318
Russell ......Paddle-wheel Vessels .. 318
Beart ......Bricks and Tiles 318
Weekly List of New English Patents 319
Weekly List of Designs for Articles of Utility Registered 320
Weekly List of Provisional Registrations 320

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GWYNNE'S PATENT DOUBLE-ACTING BALANCED PRESSURE WHEEL.

GWYNNE'S PATENT DOUBLE-ACTING BALANCED PRESSURE WHEEL.

(BY THE PATENTEE.)

In a manufacturing country like Great Britain, the economic employment of water-power is an object of national importance. Leaving out of consideration its minor applications, if we analyse the power employed in England, in the spinning and weaving factories, we shall have very conclusive evidence on the point. In the estimate of the state of the cotton manufacture, in 1833, drawn up by Mr. Baines, of Leeds, he considers that of the 44,000 horse-power employed, there are—

Steam-power	33,000
Water-power	11,000

But we have much more complete and more accurate numbers given in the returns of the factory inspectors for 1832; of which the following is a summary:—

The total mill-power in factories, subject, at that time, to inspection in England, was 83,264 horse-power.

Of these there were—

62,846 horse-power	....	Steam
20,418 ,,	....	Water:

Coinciding with Mr. Baine's general view of three-fourths steam, and one-fourth water.

In Lancashire, where coals are cheap, it might be supposed that water-power would be unused, but it is ascertained that the—

Total mill-power inspected in Lancashire, is 36,446 horse-power; consisting of—

Steam	32,123	horse-power
Water	4,323	,,

Thus one-ninth of the total mill-power of Lancashire is water-power. This shows how water-power is valued. In fact, advantage is taken of it to the full extent permitted by the oftentimes imperfect, wasteful, and costly machinery now in use. But in order to estimate how far water-power is valued, we must learn, not merely how much is used, but how much is left unused. It is calculated that the theoretical water-power of Lancashire is represented by 72,600 horse-power, taken as working continuously. Now, as only 4,323 horse-power is economised, making but 6 per cent. of the entire power available for industrial occupation, it follows that the power of 68,277 horses is allowed to run to waste, or more than twice the steam-power of the whole county.

The case in the agricultural counties is much worse, as most farmers, millers, fullers, and paper-makers,—who usually seek the rural districts—can testify.

Water-power, when administered by unskilful hands, is generally either wasted or misapplied, through the medium of clumsy machines, which are one-half their time choked with water, and at all times literally forced to work "against tide," delivering but little transmissive power, and that, too, in an uncertain and intermittent manner.

We are entitled, therefore, to repeat, that "*The economic employment of water-power is an object of national importance.*" But the value of this assertion becomes more apparent, when it is considered, that if all the rain which falls on the surface of England, in a year, were collected, it would cover the land to the depth of 30 inches in the midland and level counties, to 50 inches in the more maratime districts, and to as much as 300 inches in Cumberland and Westmoreland. Of this enormous quantity, fully one-third, as it passes to the sea, may be made available to industry, with a force proportioned to the height through which it falls. It is a power, therefore, which almost every one has within his reach: in the open country by the use of the natural streams, or the collection of surface waters; and in those towns, now increasing in number, supplied on the "constant

system," by the use of waters commercially furnished, as at Preston, Ashton-under-Lyne Wolverhampton, Nottingham, Stirling, Paisley, Glasgow, and to some extent, in Liverpool.

In the face of these advantages, the question is often asked, why so expensive an agent as steam is used for the generation of mechanical power? Want of water is the popular answer. But it is not want of water, but *the want of a water-wheel*, sufficiently simple in its structure to be durable, but sufficiently scientific in the principles of its construction, to make it a *compensating*, as well as a working engine: fitted in its mechanical arrangements to meet the fluctuating circumstances of water-power, which has led to the use of an *expensive artificial power*, in place of a *cheap natural one*—to the adoption of an engine which required skilled supervision, in lieu of one which scarcely requires oversight—to the employment of a force which cannot be economically used under a less rate of expenditure than six horses, for the purposes which do not require the aid of three: while a power is at hand, capable of profitable adaptation to the smallest as well as the largest requirements of industrial labour.

To remedy these evils, and to furnish the public with an engine of universal application, of constant action, and of great power, has been the object of the patentee of the Double-acting Balanced-pressure Wheel.

This wheel is a modification of the well-known Turbine, with additions and improvements; it is adapted to either a constant or graduating head of water, and is particularly applicable to tide water purposes, whereby the wheel will work with the tide ascending a river or inlet of the sea, or under a graduated head of water, with the tide descending and going back into the sea. A mode of regulating the variable velocity of the wheel, so that the machinery driven by it shall always work at the same velocity, is also connected with the apparatus.

The engraving, fig. 1, represents a sectional elevation of the wheel and apparatus, with the water passing through the wheel; and fig. 2 a sectional plan of the wheel. A the sluice-valve; B the water-way or pipe communicating to the annular space C around the wheel; D the bucket or partition between each space, for the ingress and egress of the water to work the wheel either way of the tide; E E the arms; F the boss or centre of the wheel;

G the step which is cast into the bottom, and forms part of the annular casing; H the vertical shaft, carrying at its upper end a bevel wheel I, working into two bevel pinions J J; K an ordinary clutch box, which is shifted from right to left by means of the handle L, for keeping the motion of the driving shaft M in the same direction when the tide turns; N a cone pulley on the end of the driving shaft, having a belt O passing round it and over the driving cone pulley P, which is fastened on the shaft in the mill or manufactory, from which the machinery is driven. Q a horizontal rod with a cotter hole in it, through which the belt passes; it is screwed from the points R to S; T a pillow block or bearing, in which revolves the screw box to receive the screwed end of the rod; affixed to the box is a pinion U, which is moved round right or left by the vertical action of the rack V, up or down; the rack having affixed to its lower end a float W, so that as the tide rises or falls, more or less head of water is given. The difference of motion, from fast to slow, or from slow to fast, is compensated for by means of the belt traversing from right to left, from the large diameter to the small, and left to right, from the small diameter to the larger of the pulleys.

The peculiar features of this wheel, and the principal improvements from any other of its class, consists in the shape of the partitions between each water-way, presenting a direct surface to be acted upon by the water in its passage through the wheel, whether the water passes into the dam through the wheel or from the dam to the river. The annular space *aa*, which contains the partitions or buckets *bb*, is cased at top and bottom, as represented and marked *cc*, both surfaces of which are turned perfectly true in the lathe; these surfaces work upon the lower, and under the upper surface of the annular casing at *dd*, but not in such contact as to cause much friction, thereby directing the water through the water-ways between each partition. The advantage of this form of bucket or partition is, that it presents a more direct and greater area of surface to the action of the water in its passage through the wheel, whether the water be going into or out of the dam. The direction in which the wheel moves is shown by the arrows in the plan.

The engravings show the wheel as used with the rise and fall of the tide. When used in stream, the bottom of the case at X is removed, and the water, after entering the wheel, falls through the opening into the tail race; the upper side of the wheel being closed in at Y.

Its experiments to others will be seen from the following comparison:—

Wheel.	Economy of Power
Undershot	about 33 per cent.
Breast......................	,, 55 ,,
Overshot....................	,, 70 ,,
Tourbine....................	,, 80 ,,
Gwynne's Double-acting	,, 85 ,,

THE ATLANTIC STEAMERS.

(From the *New York Tribune*.)

As you have so liberally appropriated your columns to the publication of an article professing to be a highly scientific and mathematical exposition of the Collins and Cunard steamers, which article,* commencing in error and ending in wrong conclusions, is well calculated to deceive many of your patrons on a subject they feel a deep and national interest in, will you please to give place to the following simple facts?—First, I will give you the dimensions of each steamer, and then show that, instead of the *Atlantic* and *Pacific* having 2,000 nominal horse power, and the *Asia* only 800, the *Asia*, with less tonnage and less displacement, has actually the greatest engines:—

	Atlantic.	*Pacific.*	*Baltic.*	*Asia.*
Length on deck	285 feet.	284 feet.	287 feet.	280 feet.
Breadth of beam	45½ ,,	45 ,,	45 ,,	46 ,,
Depth of hold	32 ,,	32 ,,	32 ,,	27½ ,,
Tonnage (Custom-house)	2,771	2,686	2,718	2,072
Load draught	20 ,,	20 ,,	20 ,,	20 ,,
Diameter of cylinders	95 in.	95 in.	95 in.	96 in.
Length of stroke..................	95 feet.	9 feet.	10 feet.	9 feet
Nominal horse power (both engines)....	800	800	828	816
Diameter of wheel	35 feet.	36 feet.	36 feet.	36 feet.
Length of buckets	12½ ,,	11½ ,,	11½ ,,	9½ ,,

* Re-published in *Mech. Mag.* No. 1480.

The term nominal horse-power has become a mere conventional unit for expressing a certain size of cylinder without reference to the power exerted, and the actual horse-power exerted by either the American or English engines greatly exceeds the nominal. This is owing to the increased pressure of steam which has been adopted in both countries since the rules for calculating nominal horse-power were established by Watt. The English designate the size of their cylinders by "horse-power," the Americans by diameter of cylinder and length of "stroke." As will be seen by the table above, the *Asia* has cylinders 1 inch larger in diameter than the *Atlantic's* or *Pacific's*, and the same length of stroke. Estimating the nominal horse-power of each by rules established in the English practice, we have for the *Asia* 816 horse-power, for the *Atlantic* and *Pacific* 800 horse-power. In order that your readers may figure for themselves, I give both rules:—1. The square of the diameter of cylinder in inches, multiplied by the cube root of the length of stroke in feet, and divided by 47, will give the nominal horse-power, thus:—

$$\frac{3}{a2 \times \sqrt{S}} = \text{nominal horse-power.}$$

a being the diameter of the cylinder in inches; *S*, the length of stroke in feet. 2. The square of diameter of cylinder in inches, multiplied by the velocity of piston in feet per minute, and divided by 6,000, will give the nominal horse.power, thus—

$$\frac{a2 \times bS}{6{,}000} = \text{nominal horse-power.}$$

a being the diameter of cylinder in inches; *b*, the number of strokes per minute; *S*, the length of stroke in feet. It is seen that the engines of the *Asia* exceed in power those of the *Atlantic* and *Pacific*. From the above statistics we find that the immersed midship section of the *Asia* is 76 square feet less than the *Pacific* or *Baltic*, and 86 square feet less than the *Atlantic*; giving per square foot of immersed midship section to the

Atlantic, 1 15-100 horse-power.
Baltic, 1 21-100 horse-power.
Pacific, 1 17-100 horse-power.
Asia, 1 34-100 horse-power.

giving to the *Asia* an important advantage over either of the others. Under this view of the case it may be asked, how can the Collins' steamers expect to equal the speed of the *Asia?* The answer is, by their superiority of model, which unquestionably gives the Collins' steamers great advantages; and when they, like the new Cunarders, can command a picked crew who have distinguished themselves by years of unremitting and efficient service, they will equal and surpass their rivals. Why do the English engineers boastingly assert, "Give us the Collins' steamers and we will beat our own by a day?" The English underrate the power of their engines, giving the impression that with less dimensions they are more perfect and more effective, while the Americans have overrated the power of theirs, and given the idea that, notwithstanding great engines, great expenditure, and great effort, their engines are imperfect, and do not work up to their power. Hence comes the frequent expression, "You can build the ships, but you must go to England for your engines." The misfortune is, the friends of the American steamers have done them the greatest injury, and illustrated the philosophy of the common expression, "killed with kindness." By over estimating and premature boasting, thereby creating unreasonable anticipations, they have done the steamers more serious injury than all foreign competition combined; for no sooner does the actual performance fall short of the highly wrought and visionary expectations, than the very vessels which foreigners have candidly pronounced without equals in the world, are by Americans themselves cried down as failures. The American steamers of the first transatlantic line were materially injured in the same unreasonable manner.

OCULAR DEMONSTRATION OF THE ROTATION OF THE EARTH.

(From the *Literary Gazette*.)

Everybody knows what is meant by a pendulum—in its simplest form, a weight hanging by a thread to a fixed point. Such was the pendulum experimented upon long ago by Galileo, who discovered the well-known law of isochronous vibrations, applicable to the same. The subject has since received a thorough examination, as well theoretical as practical, from mathematicians and mechanicians; and yet, strange to say, the most remarkable feature of the phenomenon has remained unobserved and wholly unsuspected until within the last few weeks, when a young and promising French physicist, M. Foucault, who was induced by certain reflections to repeat Galileo's experiments in the cellar of his mother's house at Paris, succeeded in establishing the existence a fact connected with it which gives an immediate and visible demonstration of the earth's rotation. Suppose the pendulum already described to be set moving in a vertical plane from north to south, the

plane in which it vibrates to ordinary observation would appear to be stationary. M. Foucault, however, has succeeded in showing that this is not the case, but that this plane is itself slowly moving round the fixed point as a centre in a direction contrary to the earth's rotation, *i. e.*, with the apparent heavens, from east to west.

His experiments have since been repeated in the hall of the Observatory, under the superintendence of M. Arago, and fully confirmed. If a pointer be attached to the weight of a pendulum suspended by a long and fine wire, capable of turning round in all directions, and nearly in contact with the floor of a room, the line which this pointer appears to trace on the ground, and which may easily be followed by a chalk mark, will be found to be slowly, but visibly, and constantly moving round like the hand of a watch dial; and the least consideration will show that this ought to be the case, and will excite astonishment that so simple a consequence as this is, of the most elementary laws of geometry and mechanics, should so long have remained unobserved. To make the matter clear, imagine that the experiment is being carried on at either of the earth's poles, so that the point of suspension may be conceived as lying in the prolongation of the earth's axis. This point will remain stationary, and the bob of the pendulum will be attracted by the earth in motion no otherwise than it would be by the earth at rest; *ergo*, the pendulum will move in *space* just as if the earth under it were at rest: consequently, to a spectator at rest on the earth it will appear to turn round from east to west for precisely the same reason as the sun and stars appear so to do, and if it were not for the resistance of the air, the torsion of the string, and other retarding causes, and the motion of the pendulum could be kept up long enough, at the end of four-and-twenty hours the plane of vibration would appear to have described a complete revolution. The above supposed experiment will be fathomed most readily by conceiving the bob of the pendulum to be at first hanging down vertically at rest, and to be set in motion by a blow in a transverse direction—the effect, however, will not be sensibly different, although rather more difficult to follow in the explanation, if the pendulum be supposed to be let fall by its own weight from an oblique position. If the same experiment were made at the equator, two extreme cases may be imagined: 1, that the motion commences in the plane of the equator; 2, in the meridian plane. In the former case, the rotation of the earth, which carries the point of suspension onwards in the same plane in which the ball commences moving, will obviously have no effect in changing the position of the plane. In the second case, it will be seen on little consideration that the plane of vibration will get pushed forward during half an oscillation, and backwards during the remaining half, and consequently its mean position never alters; and as in the two extreme cases no displacement results, it is easily concluded that at the equator, however the pendulum first begins to swing, it will keep on always vibrating in the same plane. So much for the pole and the equator; but we are more interested in knowing what ought to take place at an intermediate point in the earth's surface, as in our own latitude. To ascertain this, we may have recourse to a geometrical principle, which shows that, for the purposes of calculation, the rotation of the earth, as affecting the observed phenomenon, may be considered as made up of two parts;—one, the same as if the pole of the earth ran straight through the plane of observation, the other as if the pole of the earth were 90 degrees from the plane of observation. This latter, by what has been said about the equator, will produce no effect at all: the whole of the actual effect observed will depend, therefore, upon the former part of the rotation, the rate of which is proportional to the sine of the latitude of the place, being nothing at the equator, and greatest at the pole. Accordingly, the time that the pendulum would take (if its motion could be kept up) to describe a whole revolution is inversely the sine of the latitude.

Supposing that this very slow movement could be nicely enough observed, and allowance made for the effect of torsion, resistance of the air, and other disturbing causes, a *simple swinging weight* would enable an observer, provided with a tolerable watch, or, indeed, without any watch at all, by comparing the displacement of the plane of vibration, after a given number of oscillations, with the length of the string, to make out his latitude if he were carried blindfold into a cellar in any unknown quarter of the globe. The explanation above given of this most interesting phenomenon is substantially that stated by M. Liouville, at a recent meeting of the Institute. He has added the curious remark (which will be immediately appreciated by returning to the standard use of the experiment at the pole, and bearing in mind that for that position the string will itself be revolving about its own axis), that a feather attached to the pendulum weight will continue always to point to the same quarter of the compass, *i. e.*, will remain parallel to itself, because as much as it is carried out in one direction by the move-

ment of the plane of the pendulum, so far it will be carried back in the contrary direction by the rotation of the ball itself. This is likewise confirmed by experiment. The eminent geometer, Chasles, has suggested another mode of explanation similar to that by which the movement of the trade winds is explained, founded upon the velocity of the ball when it begins to move (supposing it be started from north to south), and which it preserves throughout, being greater than that of the several points of the earth which it traverses during an oscillation.

The effect of the rotation of the earth in influencing the movement of a body *perfectly free* has long been discussed by mathematicians, and, particularly of late years, treated with considerable detail. Again; Poisson has devoted a memoir to the study of the same effect upon a body constrained to move in a curve, and shown it to be insensible. The intermediate case of a body not perfectly free, nor yet constrained to move in a curve, but having liberty of moving anywhere in a sphere about a fixed point, seems to have escaped notice, and yet is, as we have seen, the most curious of all, giving a direct proof of the earth's rotation, by an experiment which any person may repeat for himself in his own study. The great point to notice, and which is not so readily seized by M. Chasles' mode of explanation as by M. Liouvile's, is, that the effect, although small, is accumulative in its nature, going on always increasing in the same sense, and thereby becomes amenable to observation. The universal remark which this discovery elicits from all to whom it is repeated for the first time, is unjustly, but naturally enough, not so much of praise to M. Foucault, for his ingenuity and trust in first principles in making the experiment, as wonder at the blindness of the mathematical and physical world on this point for the last two centuries that the pendulum has been treated of under every variety of form. M. Binet was at the pains of going into a long written dynamical investigation of the circumstances of the movement, before the Institute, which was generally considered to be a "luxury of demonstration." Other physicists have employed themselves more profitably in varying the experiment. M. Bravecs has contrived a very ingenious mechanism for communicating a perfectly circular movement to an oblique (or conical pendulum, as it is termed), and proposes to bring into evidence the same fact as M. Foucault has so beautifully exhibited, by comparing the *times* of revolution in the two cases, when the ball of such a pendulum moves from east to west, and from west to east; and as this kind of motion may be continued for the space of one or two hours, the effect of the earth's rotation in accelerating the apparent time of revolution in the one case, and retarding it in the other, may be made very perceptible.

This excellent and veteran geometer, M. Poinsont, the Nestor of the Institute, has suggested another extremely ingenious, but perhaps not very practical, variation of the experiment, to consist of two bodies, suspended at apparent rest to the same point, and capable of being separated by the action of a strong spring interposed between them, which at the beginning of the experiment is prevented from acting by a thread, or any other means. On burning this thread, or in any other way liberating the spring, the balls will of course fly asunder. This is all that would take place if the earth were at rest; but the earth being in motion, the balls, from the very beginning have the same motion as the point of the earth where they are suspended, which is of course the reason why they appear at rest. Now on the balls flying apart by a well-known law of mechanics, inasmuch as the *vis vivâ* will not be altered by the action of the spring, but the distance from the axis of motion is increased, the velocity will slacken, and consequently being no longer the same as that of the earth, the plane of the two strings will, at the same moment as they open out, be seen itself to move and twist round in a direction contrary to that of the earth's rotation, and thus the latent rotation of the balls which they share with the globe of the earth may be made sensible. The subject has created a great sensation in the mathematical and physical circles of Paris. It is proposed to obtain permission from the Government to carry on further observations by means of a pendulum suspended from the dome of the Pantheon, length of suspension being a desideratum in order to make the result visible on a larger scale, and secure greater constancy and duration in the experiment. The time required for the performance of a complete revolution of the plane of vibration, would be about 32 hours 8 minutes for the parallel of Paris, 30 hours 40 minutes for that of London, and at 30 degrees from the equator exactly 48 hours. Certainly any one who should have proposed not many weeks back to prove the rotation of the earth upon which we stand, by means of direct experiment made upon its surface, would have run the risk, with the mob of gentlemen who write upon mechanics, of being thought as mad as if he were to have proposed reviving Bishop Wil-

kins' notable plan for going to the North American colonies in a few hours, by rising in a balloon from the earth, and gently floating in the air until the earth should, in its diurnal rotation, have turned the desired quarter towards the suspended aëronaut, whereupon as gently to descend. So necessary and wholesome is it occasionally to reconsider the apparently simplest and best established conclusions of science.

From a Letter of Mr. J. J. Sylvester to the "Times."

That the plane in which the pendulum vibrates will travel at the rate of 15° per hour is true only at the pole; at the equator the plane will remain stationary, as will be apparent immediately in the case of the motion commencing in the direction of the east and west line, for then the point of suspension and the plane of the pendulum will all swing round together; and in the case of the pendulum beginning to vibrate at the equator in the meridian line, the plane of vibration, it may be shown, will have no visible rotation, but will merely move backwards and forwards during each half oscillation through an insensible angle, its mean position remaining invariable.

The rate of motion of the plane of vibration at any place intermediate between the pole and the equator may be shown, upon geometrical principles not easily made intelligible to the common apprehension, to vary as the sine of the latitude. Accordingly, the time required for a complete revolution would be 32 hours 8 minutes for the parallel of Paris, and 30 degrees 40 minutes for that of London. So that at the former place the motion would be at the rate of about 11¼ degrees per hour. It is not wonderful that crowds should flock to the strange spectacle of seeing the earth move, which is literally true in the same sense as a person going out to sea by watching the recession of the shores which he coasts by, perceives the motion of the vessel on which he is carried.

At the pole, but only at the pole, the pendulum will move precisely as if it were attached to a fixed point in space, and its plane of vibration will therefore appear to rotate in precisely the same way, and for the very same cause, as makes the sun, moon, and stars appear so to do. Another very interesting feature in the phenomenon is the fact that, in consequence of the "metal sphere" at the end of the wire retaining its original existent, although invisible, rotation which it shares with every particle of the earth, a feather or other indicator attached to it will always point to the same quarter of the compass, upon the same principle as causes the moon always to present the same face towards the earth. This part of the phenomenon is most easily explained for experiments supposed to be conducted at the pole, but is true for any part of the earth, and may be, and has been, actually and distinctly observed.

Strictly speaking, "the point projecting from the bottom of the sphere" is constantly changing its path, and as it always returns to the natural position of rest, it would, were it not for the resistances to which it is subject, trace out in the table beneath a series of loops or festoons, regularly and symmetrically arranged around a common centre, much like a very composite corolla of a flower with a large number of extremely elongated and crowded petals grouped around its seed vessel.

It might, I think, be possible, by means of some apparatus similar to that which Mr. Brooke has so usefully and ingeniously applied to meteorological and magnetical instruments, to make the pendulum register its own course on photographically-prepared paper.

The Reality of the Phenomenon Questioned.

(From the *Times*, April 24.)

Sir,—I have read the accounts of the Parisian experiment as they have appeared in many of our papers, and also the remarks of Mr. Sylvester on the subject, and must confess that I still remain unconvinced of the reality of the phenomenon.

It appears to me that, except at the pole where the point of suspension is immovable, no result can be obtained. In other cases the shifting of the direction of passage through the lowest point that takes place during an excursion of the pendulum, from that point in one direction and its return to it again, will be exactly compensated by the corresponding shifting in the contrary direction during the pendulum's excursion on the opposite side.

Take a particular case. Suppose the pendulum in any latitude to be set oscillating in the meridian plane, and to be started from the vertical towards the south. It is obvious that the wire by which it is suspended does not continue to describe a plane, but a species of conoidal surface; that when the pendulum has reached its extreme point its direction is to the south-west, and that as the tangent plane to the described surface through the point of suspension necessarily contains the normal to the earth at the same point, the pendulum on its return passes through the same point in the direction north-east.

Now, starting again from this point, we have exactly the circumstances of the last case, the primary plane being shifted slightly out of the meridian; when, therefore, the pendulum has reached its extreme point of excursion the direction of the wire is to the west of this plane, and when it returns to the vertical the direction of passage through the lowest point is as much to the west of this plane as it was in the former case to the west of the meridian plane; but since it is now moving from north to south instead of from south to north, as in the former case, its former deviation receives complete compensation, and the primary plane returns again to the meridian, when the whole process recurs.

This compensation is well illustrated by the similar phenomenon in the case of a body oscillating in the plane of the equator, except that on this supposition the magnitude of the arc of vibration is the quantity affected and not the direction of vibration.

Suppose the pendulum displaced to the east of the vertical in the plane of the equator. It passes through the point vertically beneath the point of suspension with a velocity less than that due to its eastern angular distance, in consequence of the motion of the earth to meet it; so that it would at first appear as if the western arc would be smaller than the eastern. In consequence, however, of the earth's motion, the pendulum requires a shorter time to reach the same angular western distance than it otherwise would do; so that the smaller velocity is sufficient to carry it to this distance, and a compensation is effected. Again; in its return from its greatest western excursion, it passes through the lowest point with a velocity *greater* than that due to its western angular displacement, and from this cause, if the earth remained stationary, would rise to a greater eastern height. In consequence, however, of the earth's motion in the same direction, it requires a longer time to reach the *same* angular distance; so that the additional velocity at the lowest point is requisite for this purpose, and it reascends to the same angular distance to the east of the vertical as that from which it originally descended. It is possible that were the problem subjected to a more rigorous analysis, the compensation might be shown not to be quite accurate; but at any rate, the effect must be always excessively minute; and the same remark applies in every respect to the shifting of the direction of vibration in any other case.

Your obedient servant,

B. A. C.

FRENCH PENDULUM EXPERIMENTS.

Sir,—I find many persons have a difficulty in perceiving what effect the rotation of the earth should have on the apparent plane of vibration of a pendulum swinging at a place on the earth's surface between the pole and the equator.

At the pole and equator there is no difficulty.

At the pole, the plane of oscillation remaining fixed in spaces, will *appear* to make a complete revolution in azimuth in one sidereal day.

At the equation there will be no change of the plane of oscillation.

At an intermediate place whose latitude is a, ω, being the angular velocity of the earth, the instantaneous motion may be resolved into three—

1. A motion of translation.
2. A motion of rotation equal to ω cos. a about an axis in the plane of the horizon.
3. A motion of rotation equal to ω sin. a about a vertical axis.

It is easy to see that the first and second will not affect the apparent plane of oscillation, and that the third will produce an apparent angular motion of the plane of oscillation equal and opposite to itself, and the plane will therefore appear to perform one revolution in twenty-four cosec. a sidereal hours.

A. S.

Lincoln's-inn, April 16, 1851.

SPEED AND POWER.—REPLY TO MR. FROST.

Mr. Editor,—In your last Number you have inserted an article by Mr. Frost, wherein he deplores that you should have published certain statements in reply to a correspondent, as to the relative power required to propel vessels on water at various velocities.

Will you allow me to observe that before Mr. Frost again writes of the "enormous errors" of others, it would be as well for him to study at least the elements of mechanics, especially as he signs himself an "engineer." He declares that he has proved by oft-repeated experiments that to obtain "double speed requires only double power, treble speed

requires treble power, and so on," and then immediately after informs us that double the weight had to descend at double the velocity to double the speed of the models used in his experiments! Would any one suppose that a schoolboy could so have committed himself? If, indeed, the experiments tried by Mr. Frost were to be depended, on they would go to show that the power required to propel a vessel is as the squares of the velocity, or that to double the speed would require four times the power, and to treble it would require nine times the power; but really when a gentleman is found drawing such very absurd conclusions from his experiments, you are compelled to doubt his capability of trying such experiments at all. The modesty with which Mr. Frost finishes his communication is highly commendable; he informs your readers that he considers himself as the greatest living benefactor of mankind, and no doubt at the appearance of his first *stamer* (mayhap illuminated with Paine's gas) propelled at *double speed with half the power* used in a similar steamer, all engineers will bow down and worship the great Frost who talks so meekly of the "incomparable value" of his "stame," and evidently applies the term "puerile verbiage" to Dr. Haycraft's communication. What a pity it is, Mr. Editor, that the ungrateful world will have it that Dr. Haycraft had previously maintained (not discovered) every particle of fact that Mr. Frost claims, and will have it that what is new in his statement is not correct, and that what is correct is not new. I will close, Mr. Editor, this too lengthy article by stating that I have seen Mr. Frost's "stame" tried in actual practice, and abandoned as of no advantage at all; perhaps Mr. Frost will deny that the stame was got up at all, and verily I believe that it has yet to be raised, but the 1st of May is drawing near, and perhaps the Crystal Palace will be chosen to show the reality of this gem of the most expanded water to the world.

J. B. G.

April 15, 1851.

FLAX-DRESSING HOLDER.

(Registered under the Act for the Protection of Articles of Utility. John Martin, of Killyleagh Mills, Down, Ireland, Proprietor.)

Fig. 1.

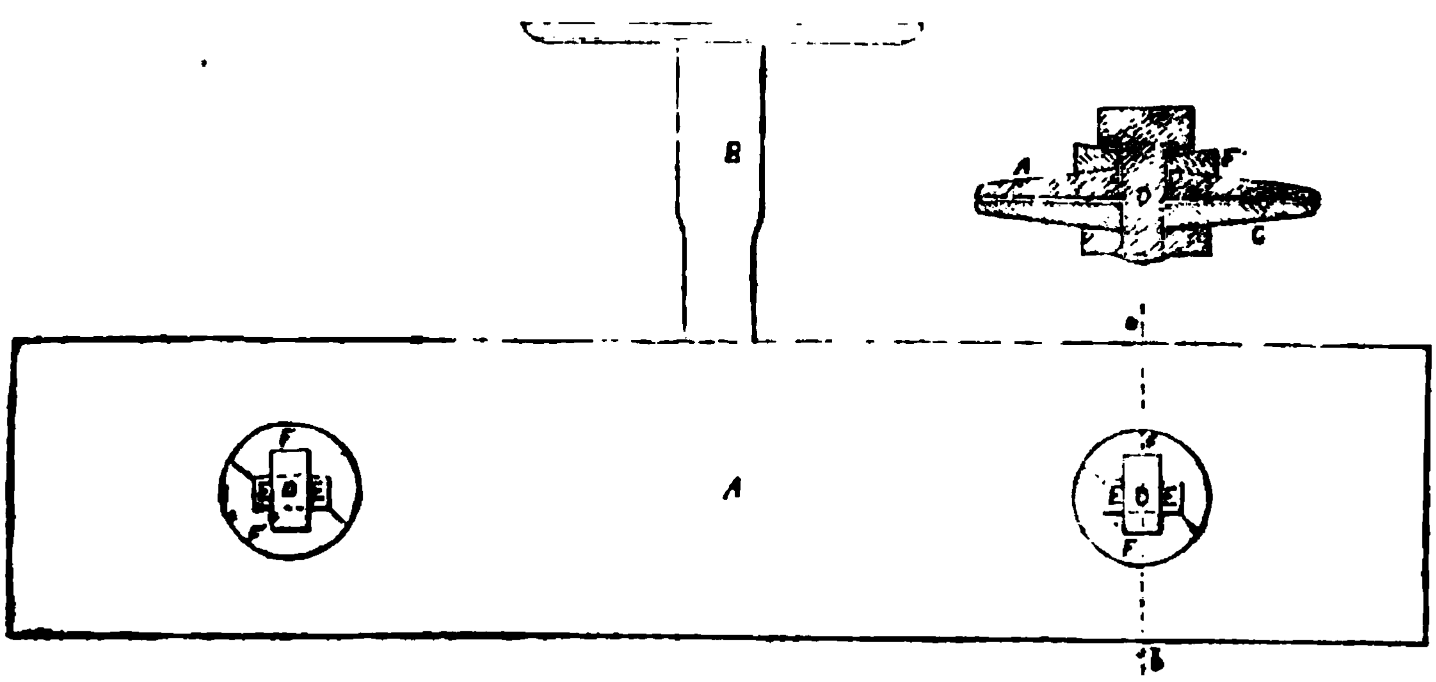
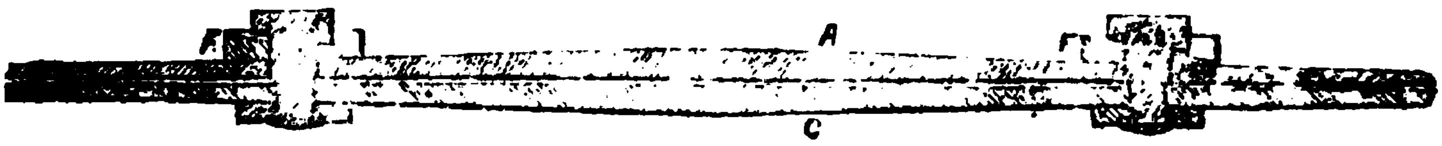


Fig. 2.

Fig. 3.



In the above engravings fig. 1 is a side-elevation, fig. 2 an end-elevation, and fig. 3 a plan of this holder. A is the bottom plate, B the handle and cross-head by which the holder is suspended in the hackling machine; C is the top plate; D D are two "turn-pins," or locking bolts, which are passed at one end through the lower plate A, into which they are securely riveted or fixed,

so that they cannot come out, but are yet left sufficiently loose to be easily turned round; the other and free ends of the bolts D D terminating in cross-heads or T-pieces, which have corresponding holes E E cut in the upper plate, and through which they are passed when the flax to be held has been laid in its place. F F are projections or washers, the upper surface of which forms two inclined planes; the lower surfaces of the cross-heads of the bolts are similarly inclined. By this arrangement, as the bolts are turned round, their cross-heads gradually ascend the inclined planes and cause the two plates to be drawn together, and take a firm hold of the flax.

BUOYANT MASTED LIFE-BOAT.

Sir,—I send you a sketch of a life-boat on a new principle, which, if I mistake not, will be found to possess the property of *insubmergability* in a higher degree than any yet proposed.

The figure represents a side view of the boat, with the ends of the air-cylinders (AA) that cover her decks, which are to be four feet deep, and also of those (BB) under her bottom, which are to be three feet deep; it also shows the steam engine C, which runs fore and aft, with the screws DD attached.

I purpose that it should be a flat-bottomed boat, and made of gutta percha—50 feet long, 15 broad, and 5 feet 8 inches in the hold, which will be sufficiently high for the generality of men to stand upright in. Her fastenings are to be of rod iron, so as to form her frame and ribs; not to be riveted, but fastened together with nuts and bolts, longitudinally or otherwise so arranged that they may all move at right angles, so that if the boat should strike against either of her corners, the whole of the boat will take an equilibrium of bearing, and no part of her would be destroyed, but merely

put out of shape, which could be easily remedied by unscrewing the nuts and loosening them.

The air funnels EE are on a principle of my own invention, and, to the best of my belief, new; they consist of three funnels, which are each to rise 30 feet above the deck, and are made of sail-cloth rendered air-tight by an India-rubber or gutta percha solution inside and out, and kept extended by means of iron hoops, which are to be hoisted up to form the funnel, and let down at pleasure, in the same way as the sails of a ship. They are to be kept up in heavy weather, or when the boat is loaded, twenty feet above her deck, so that she would always keep an erect position, and always be safe when navigating even at that depth, as she would then have ten feet of funnel above the water: they are to be fitted and fastened in some mechanical way by which they will be perfectly air-tight with the deck. The iron masts FF, from 30 to 33 feet high (which are to support the air funnels), are to be provided with blocks at the top to hoist the funnels up, and to be so constructed that either of them may be taken out and another one put in at pleasure, and to be fastened with nuts and bolts to three or four iron hoops, to keep them firm—such hoops to be stayed with iron rods to the hoops of the masts which support the other funnels, so that the whole of the iron masts may be stayed or fastened together.

The boat ought to have six oars at each side to be worked when not too deep, or in fine weather; but when she is deep or the weather very heavy, the man-engine only can be used. This is to be so fixed that the water pumps may be worked with it if required, and to have attached to it two small screws, one at the extreme angle near her side at the head, and one at the stern, to be used to bring her round instead of a helm. I think she ought to carry, to supply air to the cylinder, at least sixty-four pairs of bellows made to screw into her; thirty-two for her sides, and sixteen for the top and bottom of the boat, to be used by the passengers as they go on board her. The air-cushions I propose to be kept up tight to her by means of strong India rubber ropes, which will only give way upon pressure of the air from the inside.

Persons more skilled in the buoyancy of atmospheric air are better able to judge of the weight she will carry than myself, but she will provide seats for about 150 persons, while fifty persons can stand and work the engine; my own opinion, however, is that her passengers will be perfectly safe at a depth of 25 feet under the surface of the water.

I am, Sir, yours, &c.,
GEORGE FIRMIN.

1, St. Mark's-place, Bath,
March 24, 1851.

COLOURED PHOTOGRAPHS.—THE HILLOTYPE.

Sir,—Having for the past year been engaged experimenting with the view of obtaining coloured photographs, I read with interest an article in your Magazine (*ante* p. 296), stating the brilliant discovery of Mr. Hill. Like that gentleman I was led to suppose there was a latent coloured impression on the usual Daguerreotype plate, and with the view of developing that impression, I was led to employ the vapours of various substances; as arsenic, zinc, preparations of mercury, gum benzoin—in fact every substance that is capable of sublimation; gum bezoin produced pictures little inferior in appearance to mercury. I also found that a very curious result was produced by coating a plate with iodine, and applying the heat of a spirit lamp to the back of the plate; it quickly assumes a white appearance, and is then capable of receiving an impression the same as if coated with iodine and bromine. If when taken from the camera, in the dark, it is covered by a piece of red glass, and placed in the sun-light, it is almost instantly produced. In some of my experiments I have obtained distinct indications of colour, and am inclined to think that when Mr. Hill's process is known, other methods will speedily be discovered, both on paper and plates. After forming a host of metallic and non-metallic compounds, exposed plates under coloured glass, to various chemical preparations, to vapour, fluoric gases, &c. (in some of which very curious effects have been produced), I failed to produce a compound that would cause the plate to yield up all its latent sun-tinted hues; still I believe it possible, and am glad the more successful results

of Mr. Hill have removed all doubts on the subject. It is gratifying to know there is still a vast untroden field, offering many inducements to the careful experimentalist, in which he cannot fail of being rewarded by new discoveries; for it must be acknowledged that we are still unacquainted with many of the secret influences and mysterious operations of light. I trust Mr. Hill will receive the honour he so justly deserves, and that it is not preposterous in me to hope that our Government will follow the example of France,—purchase the secret, and present it to the nation.

Yours very respectfully,

B. Hunt.

11, Trafalgar-terrace, Greenwich.

Further Communication from Mr. Hill to the "Daguerrian (New York) Journal" of March 1.

I have now fifty-five specimens. They are all equally perfect. It is quite remarkable that I have never yet made a *partial* failure. Those impressions which have had too much light, are nearly as strong, sound, brilliant and beautiful as those correctly timed in the camera, being inferior only in having the colours less deep. Even the whites retain their strength. The folds of the linen are *always* well defined. Blue or solarized linen is unknown in my process, and there is always a strength and clearness in the whites unattainable by mercury. During the past winter I have several times taken a view in which there is a deep red house, while the ground was covered with snow. For experiment I expose the plate so long as to reduce the bright red of the house to a *very light red*, while at the same time, the white snow was developed with a beautiful whiteness.

I have copied several very highly coloured French prints. The copies are far superior to the originals in that, while they have *every* tint of colour, they are exceedingly brilliant. This is a characteristic in which I never fail, even with the plates merely cleaned with rotten-stone — the brilliancy depending on *other causes*. Well polished plates, however, are preferable for other reasons. It is *essential* that the plates should be very pure, free from scum, dampness, and organic matter of every kind, and I am experimenting with different substances in hopes of finding something that will more perfectly cleanse, while it thoroughly polishes. I would be very thankful to any person who might furnish me with valuable hints on this point, as I am convinced that here lies one great cause of uncertainty.

My trouble with the *yellow*, which you mentioned in the last Number of the *Daguerreian Journal*, relates only to the homogeneous rays; orange, buff, and all the various shades of yellow come out true except the *chrome yellow*, which appears less brilliant. This, however, is thought by distinguished artists no serious objection.

PATENT LAW REFORM.—THE GOVERNMENT BILL.—NO. II.

Lord Brougham's Bill (*see ante* p. 291,) has been followed by the presentation of another, marked "No. 2," by Earl Granville, on behalf of the Government; and both stand now referred to a Select Committee of the Lords.

The Government Bill has been evidently framed on Lord Brougham's, and differs from it in not many important particulars. The most prominent of these we shall notice in the order in which they occur:

Preamble—same in both Bills.

The Commissioners nominated by Lord Brougham's Bill are the Lord Chancellor, the Master of the Rolls, the Attorney-Generals for England and Ireland, Solicitor-Generals for England and Ireland, the Lord Advocate and Solicitor-General for Scotland. The Government Bill proposes to add *Her Majesty's principal Secretaries of State.*

The powers given to the Commissioners by both Bills are equally large, but by No. 2 all rules made by them are to be laid before both Houses of Parliament within fourteen days after the making thereof, if Parliament be sitting, and if Parliament be not sitting then, within fourteen days after the next sitting of Parliament."

The petition for grants of Letters Patents is by No. 1 to be left at "the Great Seal Patent-office; by No. 2, at the office of one of Her Majesty's Principal Secretaries of State." The present practice is to leave it at the office of the Secretary of the Home Department.

The petition is, according to No. 2, "to be accompanied with a statement in writing, signed by or on behalf of the applicant, describing the nature of the machine;" and the petition and statement are to be referred to the Attorney or Solicitor-General, who is to report whether the statement is "sufficient," and to have power to allow it to be amended.

By No. 1, the petition is to be referred "to such person or persons as the Commissioners shall from time to time appoint to

consider and report thereon;" and the inventor is then to lay before such person or persons a "statement" of the invention similar to that required in the first instance by No. 1 Bill. This seems to contemplate the appointment of some other "person or persons" than the Attorney and Solicitor-General to report on patents.

One Patent is, according to No. 1 Bill, to suffice for the "United Kingdom of Great Britain and Ireland, the town of Berwick-upon-Tweed, the Channel Islands and the Isle of Man, and all the colonies and possessions abroad." In No. 2 Bill, the *colonies and possessions abroad* are left out. Why?

No. 2 Bill provides, nevertheless, that Letters Patent extending only to Scotland or Ireland may be granted as heretofore.

The Bill No. 2 contains a clause for "*provisional*" protection, to which there is nothing similar in Lord Brougham's Bill. It is in these words:—

After the commencement of this Act, the first and true inventor of any invention for which Letters Patent might be lawfully granted may, upon payment according to the rules to be made under this Act, of the sum of two pounds, deposit or file in such office or place, and in such manner as may in this behalf be directed by such rules as aforesaid, an instrument in writing under his hand and seal, to be called a Provisional Specification, particularly describing and ascertaining the nature of such invention, and in what manner the same is to be performed; and such deposit or filing of such provisional specification shall confer the like powers, rights, and privileges for the term of Six Months from the date of such deposit or filing as might have been conferred upon such inventor by Letters Patent for such invention extending to the whole of the United Kingdom, the Channel Islands, and the Isle of Man, and duly sealed as of the day of the date of such deposit or filing; and upon the payment according to such rules for the further sum of Twenty Pounds, such inventor shall have and enjoy such powers, rights, and privileges for the further term of Six Months; and certificates shall be issued, in such form as may be prescribed by such rule, of the deposit or filing of such provisional specification, and of such further payment respectively by such person as may be appointed by the Commissioners in this behalf, and Letters Patent may be granted in respect of such invention at any time while such inventor is entitled under this provision to such powers, rights and privileges as aforesaid; and such Letters Patent shall, notwithstanding the use or publication of such invention at any time after the deposit or filing of such provisional specification, be of the same validity as if such provisional specification had not been deposited or filed as aforesaid, and such invention had not been so used or published; and any such Letters Patent may be sealed as of the day of such deposit or filing; but no Letters Patent for such shall be used out or granted after such inventor ceases to be entitled under this provision to the powers, rights, and privileges aforesaid; and where Letters Patent are granted in respect of such invention, the provisional specification shall be deemed the description of such invention, and no other specification shall be filed or deposited in respect thereof: Provided that all the provisions of the Act of the Session holden in the Fifth and Sixth years of King William the Fourth, chapter Eighty-three, concerning disclaimers and memoranda of alterations, shall, subject to the rules to be made under this Act, extend and be applicable to the provisional specifications to be deposited or filed under this Act.

The following clauses belong also exclusively to No. 2 Bill.—Both good.

Where the Report of her Majesty's Attorney-General, or Her Majesty's Solicitor-General, upon any petition for Letters Patent for any invention, has been made before the passing of this Act, no Letters Patent shall be granted in pursuance of such petition, unless the same be sued out within Three Months from the passing of this Act: and no Letters Patent for any invention shall be granted in pursuance of any petition (whether presented before or after the passing of this Act), upon which the report of such Attorney or Solicitor-General is made after the passing of this Act, unless such Letters Patent be sued out within Three Months after the date of such report.

The use or publication in any foreign country, or in any of her Majesty's Possessions abroad, or in the Channel Islands, or the Isle of Man, of any invention before the date of any Letters Patent to be granted for such invention under the Great Seal of the United Kingdom, the Seal appointed to be used instead of the Great Seal of Scotland, or the Great Seal of Ireland, in pursuance of any petition presented after the commencement of this Act, shall have the like effect with respect to such Letters Patent as if such use or publication had taken place in the United Kingdom, or the part thereof for which such Letters Patent may be granted.

Lord Brougham proposes that the Commissioners shall from time to time cause all Specifications, Disclaimers and Memoranda of Alterations "to be printed by her Majesty's printer, and to be published at reasonable prices." The Government Bill omits this.

The Schedule of Fees is the same in both Bills, with the exception that the cost of the first term of three years will, by No. 1, be 30*l.*, and by No. 2, only 19*l.*

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING APRIL 23, 1851.

JAMES YOUNG, of Manchester, Lancaster, manufacturing chemist. *For improvements in the treatment of certain bituminous mineral substances, and in obtaining products therefrom.* Patent dated October 17, 1850.

This invention consists in treating bituminous coal in such manner as to obtain therefrom an oil containing parafine (which the patentee calls parafine oil), and from which oil parafine is obtained. The coals best fitted for this purpose are such as are usually called parrot coal, cannel coal, and gas coal, and which are much used in the manufacture of gas for the purpose of illumination, because they yield, upon distillation at a high temperature, olefiant and other highly illuminating gases in considerable quantity; and although some of the coals last described contain a large amount of earthy

matters, those matters do not interfere materially with the performance of this process. To obtain parafine oil from coals, the following is the method of procedure:—The coals are to be broken into small pieces, and are then to be put into a common gas retort, to which is attached a worm pipe passing through a refrigerator, and kept at a temperature of about 55° Fahr. by a stream of cold water. The temperature of the refrigerator should not be made too low, lest the product of the distillation should congeal and stop up the pipe. The retort being closed in the usual manner, is then to be gradually heated up to a low red heat, at which it is to be kept until volatile products cease to come off. Care must be taken to keep the temperature of the retort from rising above that of a low red heat, so as to prevent as much as possible the desired products of the process being converted into permanent gas. The coke or residue may then be withdrawn from the retort, which, being allowed to cool down below a visible red heat (to prevent waste of the fresh material to be introduced), may be again charged with a quantity of coals to be treated in the like manner. The crude parafine oil distilled or driven off from the coals as a vapour, will be condensed into a liquid in passing through the cold worm-pipe, from which it will fall into a vessel which must be provided to receive it. Instead of obtaining the whole of the parafine oil by distillation, a portion of it may in some cases, if thought desirable, be run from the retort (through an opening and a pipe provided in the anterior and lower part of the retort for that purpose) after it has separated from the coal and assumed a liquid form. The patentee prefers, however, in every case to distil or drive off the whole of the parafine oil to be obtained from the coal. The production of the desired products from a charge of coals in a retort will be known to be finished by the liquid ceasing to run from the worm. The crude product of this process is an oil containing parafine, which the patentee calls parafine oil. This oil will sometimes, upon cooling to a temperature of about 40° Fahr., deposit parafine. Other arrangements of apparatus may be used for subjecting coals to the process for obtaining parafine oil therefrom, but that above-mentioned is preferred as being well known and easily managed. But in order to obtain the largest quantity of crude parafine oil from coals by means of this process, and produce the smallest quantity of permanent gas by the action of the heat employed, whatever may be the apparatus used, care must be taken to heat the coals gradually, and to apply the lowest temperature necessary to complete the operation. During the distillation or driving off, a permanent gas will be produced, and this gas may either be collected or suffered to escape, as may be thought expedient. The crude oil obtained, as already described, is purified in the following manner:—I put the oil into a cistern, and heat it (by a steam pipe or other means) to a temperature of about 150° Fahr. When thus treated, water and undissolved impurities contained in the oil will separate more readily from it than when cold, and the oil being left in a state of rest and kept warm for about a day, many of those impurities will fall to the bottom of the cistern, and the oil may then be run off into another vessel, leaving the residuum behind. For distilling the oil the inventor prefers to use an iron still with a worm-pipe connected to it passing through a refrigeratory apparatus, which is kept at or about the temperature of 55° Fahr., as already mentioned. The still is heated by a fire underneath it, which is kept up until the whole of the oil has been distilled over, and it will then be found that the still contains some dry carbonaceous residuum, which should be taken out before the still is again used. The oil is to be run from the condensing apparatus as it distils over into a leaden vessel, where to each 100 gallons there are gradually added 10 gallons of the oil of vitriol of commerce. After this mixture has been well stirred for about an hour, it is to remain at rest for about twelve hours, so that the oil of vitriol and the impurities with which it has combined may settle at the bottom. The supernatant oil is then drawn off into an iron vessel, and to four gallons of a solution of caustic soda, of a specific gravity 1·300 (water being 1·000), added to each 100 gallons. The soda and oil are stirred together for about an hour, so as to neutralize any acid which may remain in the oil, and also take up any impurities capable of combining with it, after which the contents of the vessel are allowed to remain at rest for about six or eight hours, so that the solution of soda may subside, and then the supernatant oil is to be drawn off, and again distilled in the same manner as already described. Parafine oil obtained from the last mentioned distillation contains a fluid more volatile than parafine, a considerable portion of which may be separated from the oil and obtained in a separate state as follows:—The oil is placed in an iron still connected with a worm-pipe passing through a refrigeratory apparatus, and half its bulk of water being added, the contents of the still are boiled for about twelve hours, adding water from time to time, so as to keep about the same proportions of oil and water in the still.

The volatile fluid will pass over along with steam, and be condensed in the worm-pipe by the refrigeratory apparatus. This fluid will be clear and transparent, and as it is lighter than water, it separates, on standing, from the water with which it will be mixed as it leaves the worm-pipe of the still. This fluid may be burnt for the purpose of illumination, or applied to any other useful purpose to which it may be applicable. The last-named process will separate the greater portion of the volatile fluid from the oil; but a larger quantity may be separated by prolonging the operation. The oil left in the still after the completion of the process is then to be carefully separated from all the remaining water (upon which it will float) and conveyed into a leaden vessel, where two gallons of oil of vitriol are to be added to each 100 gallons. This mixture is to be well stirred for six or eight hours, after which it is allowed to stand undisturbed for twenty-four hours, in order that the vitriol may settle to the bottom of the leaden vessel, carrying with it all impurities with which it has combined. The supernatant oil is now to be drawn off into another vessel, and to each 100 gallons there is added 28 lbs. of chalk, ground up with a little water into a thin paste. The oil and chalk are to be well agitated until the oil becomes entirely freed from any trace of sulphurous acid, which may easily be known by heating a little of it in a glass retort, and testing its vapours by moistened blue litmus paper. If the vapours change the colour of the litmus paper to red, the oil must be treated with more chalk. This oil is to be kept warm—say at 100° Fahr.—in any convenient vessel for about a week, to allow impurities to settle, and it is then fit to be used for lubricating purposes, either by itself or mixed with an animal or vegetable oil, or it may be burnt by itself in argand lamps for the purpose of illumination. To extract parafine from the purified parafine oil obtained in the manner described, the oil is to be cooled to a low temperature—say to 30° or 40° Fahr.; and the lower the temperature, the larger will be the quantity of parafine separated from the oil. In this way parafine is made to crystallize, when it may be separated from the oil by filtration through woollen or other cloths, and then squeezing it in a powerful press, by which means it will be made sufficiently pure to be employed for lubricating and some other useful purposes. But the parafine may be further purified, if required, by treating it several times, at a temperature of about 160° Fahr., alternately with its own bulk of oil of vitriol and with a similar quantity of a solution of caustic soda (of the specific gravity already mentioned) until the parafine ceases to render the oil of vitriol black. It is then to be washed in a weak solution of soda, and lastly with boiling water, until the water ceases to change the colour of red litmus paper. Another method adopted to obtain parafine from parafine oil is, to put the oil into a still, and distil over one half or more of its contents. The portion then remaining will contain a much larger proportion of parafine than the parafine oil at first put into the still contained; this residue being then distilled over into a separate vessel, and allowed to cool. Parafine may be separated by filtration and squeezing in cloths, and also purified by treatment with oil of vitriol and soda, as before described. Parafine oil from which parafine has been separated, as above described, still contains parafine in solution, and is suitable for lubricating or lighting purposes.

Claim.—The obtaining of parafine oil, or an oil containing parafine, and parafine from bituminous coals, by treating them in manner before described.

George Michiels, of London, gentleman. *For improvements in treating and preparing potatoes for seed.* (A communication.) Patent dated October 17, 1850.

According to the patentee's method the germs or eyes of the potatoes are removed by means of an instrument consisting of a small tube mounted in a hollow conical handle, and provided with a collar or flange to prevent its penetrating to an unnecessary depth, after which they are sprinkled with powdered charcoal (preferring that made from the white poplar) and packed in barrels in layers, with charcoal between each, in order to preserve the eyes or shoots for seed, and admit of their being readily transported from place to place. The potatoes after the removal of the eyes, may be used for alimentary purposes.

Claims.—1. The extraction of the eyes or shoots from potatoes surrounded by a uniform and very small portion of the flesh of the tuber by means of an instrument adapted and regulated to pass into the potatoe to the base of the eye or shoot, so as to remove the eye or shoot with a minimum portion of the flesh.

2. The employment for this purpose of the instrument described, and especially in the said instrument the application of a collar, to prevent the point of the instrument from penetrating to a greater depth than that of the base of the eye or shoot.

3. The application of powdered charcoal to the eyes or shoots, to effect their preservation as seed.

Henry Bernoulli Barlow, of Manchester, consulting engineer. *For improve-*

ments in spinning cotton and other fibrous materials. Patent dated October 17, 1850.

The improvements here claimed consist in the application to the front drawing roller, or to a calender roller in front of the said drawing roller, of an arrangement for supplying moisture to the roving before it is converted to a yarn by putting in the twist.

1. A trough containing water or other liquid is placed in such manner as to allow the front drawing roller (which should be made of a metal not liable to oxidize by contact with water) to revolve therein. The roving being thus drawn in a dry state, and afterwards moistened before passing to the bobbin, the ill consequences now resulting from drawing the rovings in a wet state will be avoided. In order to prevent injury to the upper roller from contact with the moistened roving, it is to be covered with India-rubber or some other similar material.

2. A pair of calender rollers, the lower one of which revolves in a trough of water, are mounted in front of the front drawing rollers, through which the roving passes to the bobbin when the drawing operation is completed. Pressure may be applied to the upper calender roller to prevent an excessive degree of moisture being applied to the roving. This arrangement is preferred by the patentee to that previously described, as being less liable to cause the roving to lap or be drawn round the roller.

JOHN FOWLER, jun., of Melksham, Wilts, engineer. *For improvements in steam engines, in raising and forcing fluids in irrigating and draining land, and in machinery for cutting wood for drain pipes and other uses.* Patent dated October 17, 1850.

These improvements have relation,

1. To a method of working the slide-valves of steam engines by admitting the steam to act alternately on the opposite ends of the slide, and produce the motion requisite for opening and closing the steam ports of the cylinder. (The same principle is applied also to rotary engines.

2. To an arrangement of ploughs for forming the furrows and introducing the drain pipes into the subsoil at one operation.

3. To machinery for sawing and boring wooden pipes.

No claims.

THOMAS RICHARD HARDING, of Lille, manufacturer. *For improvements in machinery for heckling and carding flax, in machinery for combing and drawing wool and other fibrous materials, and in machinery for making parts of such machines, and for a new arrangement of the steam engine for driving flax and woollen mills, which arrangement is also applicable to other purposes where motive power is required.* Patent dated October 17, 1850.

Claims.—1. An arrangement for heckling both sides of a strick of flax, by passing it once only through the machine, and without turning the flax.

2. Giving a continuous traverse motion to the guides or carriers of the flax-holders, by which means the flax may be submitted to the action of the heckles without any necessity for a reverse or intermittent motion to effect the proper heckling of the flax.

3. Bringing the flax in contact with the heckles by means of atmospheric pressure, and causing a blast of air to impinge against the back of the heckles to remove the tow from the heckle pins.

4. A method of constructing card cylinders and porcupine rollers or cylinders. The working surfaces of the card cylinders are covered with strips of plate metal, provided with steel teeth or pins wound helically around the cylinders, and the porcupine rollers are made of tubing pierced with numerous holes in helical lines, for the insertion of pins.

5. An arrangement of apparatus for boring helical lines of holes in the card plates and cylinders.

6. A method of securing the pins in such rollers or cylinders by hammering.

7. An arrangement by which an oscillating motion is given to rotary combs.

8. Constructing oscillating steam-engines in such manner that the steam may be admitted to work the piston of one cylinder, and then exhausted into a second cylinder, or into two cylinders (as in Woolf's engine), by which means the piston of the high-pressure cylinder and the piston of the low-pressure cylinder, or the pistons of the low-pressure cylinders (as the case may be), will be caused to traverse simultaneously in opposite directions.

In one arrangement described by Mr. Harding, a small cylinder is placed concentrically within a second cylinder, and the annular space thus formed occupied by a piston of corresponding shape. The steam is admitted into the small cylinder, and when its piston has reached the end of the stroke, is exhausted into the annular space, and causes the piston in this space to traverse in the opposite direction. Both pistons then continue to work simultaneously in opposite directions, and their motion is transmitted to the mill-shafting by means of two bevel-wheels of the same pitch, gearing into a pinion on the said shaft. Or, the exhaust steam may be caused to work two small cylinders, the pistons of which are

connected by a crosshead, and impart their motion to the mill-shaft in a manner similar to that firstly described.

JAMES HENRY BADDELEY, of Shelton, Stafford, engineer and designer. *For improvements in the manufacture of ornamental articles of earthenware.* Patent dated October 17, 1850.

Mr. Baddeley's improvements have relation to the manufacture of all such articles of earthenware having designs in relief on their surface, such as ornamental bricks, cornices, &c., as are capable of being removed in a perfect state from the mould.

The clay is first subjected to a preparatory process of fining and mixed with about one-twentieth part of its weight of sand, and a small quantity of soda or salt, to act as a flux to the sand when burnt. It is then put in a press from which it is forced into the moulds, where the process is completed by a machine similar to a fly-press. The moulded articles are finally baked, to fit them for use.

Claim.—The application of the process described to the production of all such articles of ornamental earthenware having designs in relief on their surfaces as are capable of being removed in a perfect state from the pattern-plate or mould.

JAMES HENRY WILLIAMS, of Birmingham, manufacturer. *For certain improvements in the manufacture of buttons.* Patent dated October 17, 1850.

The patentee describes and claims,

1. A variety of methods of making or manufacturing buttons, and the appendages thereto.

2. The application of ornament to the surfaces of metallic buttons by imprinting by means of engraved blocks or rollers. The design is printed on with a mixture of sulphate of copper and tin, and varnished to preserve it.

3. A method of preparing zinc to be manufactured into white buttons. The zinc is first scraped clean, then immersed in a solution of muriate of tin, passed between rollers, dipped again, and finally cut into discs for making the buttons, which are polished and burnished in the usual way. Or it may be immersed in weak stripping aquafortis, then in corrosive sublimate, and finally in strong caustic ammonia, to neutralise the effects of the corrosive sublimate.

DANIEL TOWERS SHEARS, of Bankside, copper merchant. *For improvements in the manufacture and refining of sugar.* (A communication.) Patent dated Oct. 17, 1850.

The improvements here claimed comprehend,

1. The application of apparatus which the patentee calls "rousers or displacers," for expelling from the vacuum-pan the sugar, when evaporated, to such a state of dryness as to render its removal difficult by the ordinary methods; and also for mixing with the dry sugar the thick liquor which is introduced, to bring it to a state in which it may be easily removed.

2. A method of operating with the rouser, in which the cold water is passed through the steam pipes to prevent the sugar from adhering to them previous to its expulsion by the rouser.

3. Another method in which thick liquor is introduced at the bottom of the pan, and the ejection of the sugar commenced when a sufficient quantity has been allowed to enter to saturate the sugar.

4. The application of cold air to the vacuum pan by means of a pipe, perforated with numerous small holes, to facilitate crystallization.

5. A method of making refined sugar at one operation from beet-root and other saccharine juices, without the necessity of converting the juice into raw sugar. The juice is crystallized in very large pans, and the syrup is extracted by the centifrugal machine or otherwise from the crystals, which are afterwards reduced to the necessary consistence for introduction into the moulds which are arranged in the centrifugal machine, with their apices pointing towards the circumference.

6. A method of maintaining the steam in the steam spaces of the vacuum pan, at a uniform pressure.

7. A method of reducing West India molasses, khoar, or other saccharine substances, to a thin solution, and purifying and treating them for conversion into loaf sugar. Also a mode of crystallizing to dryness West India molasses, khoar, and other saccharine substances, either individually, or in combination with each other, or with raw sugar, by continuing the operation of evaporation of the formation of the crystals.

8. The refining of sugars by the introduction into them of an alkali or alkalies (prepared lime or wassama), and an acid gas or gases (by preference, carbonic or sulphurous acid gas).

9. An apparatus for boiling sugar, consisting of three pans, the first of which is exposed to atmospheric pressure, and generates steam to supply the other two in which the sugar is boiled in a vacuum. The sugar is here concentrated to about 10° Baumé; in the second it is reduced to 25° or 27°; and in the last pan the operation is completed, and the sugar brought to "proof."

10. A system of carrying on the process

of evaporation, after the liquid has been brought to "proof," in order to obtain crystallised sugar therefrom in a state of dryness, using suitable means for keeping down the temperature, thus avoiding the usual method of crystallization when the liquid has been brought to proof.

JOHN ROBERT JOHNSON, of Crawford-street, chemist. *For improvements in fixing colours on fabrics made of cotton and other fibre.* Patent dated October 17, 1850.

AARON ROSE, of Halesowen, Worcester, manufacturer. *For a certain new or improved method, or certain new or improved methods of manufacturing twisted gun and pistol barrels* Patent dated October 24, 1850.

In carrying this invention into effect, a rod of iron or steel, or of a mixture of both, of sufficient length and thickness to form the gun or pistol barrel, is wound into a compact coil, which is then placed on an anvil with a semicircular groove, and submitted to the action of a tilt hammer, the face of which has also a corresponding groove for the purpose of improving the shape of the said coil previous to welding the seams. This operation is performed by bringing the coil to a welding heat in an air furnace or hollow fire, and passing through it by suitable apertures made in the sides of the furnace a rod or mandril, provided with a washer which bears against one end of the coil, and causes the opposite end to abut against the side of the furnace. The projecting end of the rod is then subjected to repeated hammering, by means of which the seams are forced close together and the welding effected. The welding may be performed in a similar manner out of the furnace, but the coil will in that case require to be heated twice or three times during the operation. After welding, and in order to give the partially formed the necessary finish, it is again subjected to the action of the tilt hammer and passed through rollers without any internal support; in both cases a stream of water is applied to carry off the scale displaced by the hammering or rolling operations.

Claims.—1. The use of the machinery described for wrapping up or coiling metallic rods for making gun and pistol barrels.

2. The method of forcing up by hammering the twists or seams of partially formed gun and pistol barrels while at a welding heat, and while either in or out of the air furnace or hollow fire in which they have been heated by means of a rod of iron furnished with a ring or washer, and passed through the coil or partly formed barrel.

3. The use of a hollow fire or air furnace for heating the coil of which the gun or pistol barrel is composed, whether the coil be made by the method described or by any other method.

4. Passing the partially formed barrel through rollers without a mandril or internal support while at a welding heat.

5. The employment of the tilt hammer and anvil to improve the shape of the coil previous to welding, and to finish the barrel while at a welding heat.

LIST OF SCOTCH PATENTS FROM 22ND OF MARCH TO THE 22ND OF APRIL, 1851.

David Davies, of Wigmore-street, Cavendish-square, Middlesex, coach-maker, for certain improvements in the construction of wheel carriages and in appendages thereto. March 24; four months.

Charles Zavier Thomas (de Colmar), Chevalier de la Legion d'Honneur of Paris, in France, for an improved calculating machine, which he calls Arithmometer. March 25; four months.

William Milner, of Liverpool, Lancaster, patent safe and safety-box manufacturer, for certain improvements in safes, boxes, and other depositories, for the protection of papers or other materials from fire. March 26; six months.

John Stephens, of the Albynes, Assley Abbotts, Salop, gentleman, for certain improvements in thrashing machinery. March 28; six months.

James Cheetham, jun., of Chaderton, near Oldham, Lancaster, manufacturer, for certain improvements in the manufacture of bleached, coloured, or party-coloured threads or yarns. April 2; six months.

James Black, of Edinburgh, machine-maker, for a machine for folding. (Partly communication.) April 3; six months.

William Boggett, of St. Martin's-lane, Middlesex, gentleman, and William Smith, of Margaret-street, in the said county, engineer, for improvements in producing and applying heat in lighting, and in engines to be worked by steam, or other elastic fluid, which engines are also applicable to pumps. April 3; six months.

Henry Duncan Preston Cunningham, of Bury, Hunts, paymaster in the royal navy, for improvements in reefing sails. April 4; six months.

James Hamilton Browne, of the Reform Club, Pall Mall, Middlesex, Esq., for improvements in the separation and disinfection of fecal matters, in the purification of gas, in the preservation of animal matters, and in the apparatus employed therein. April 9; six months.

Thomas Greaves Barlow, of 32, Bucklersbury, London, civil and consulting gas engineer, and Samuel Gore, of Park-road, Old Kent-road, Surrey, engineer, for improvements in certain substances used in the production of gas, for giving light and heat, and some of the products of the said substances, as also in the apparatus employed in the manufacture of such gas, and in discharging and giving motion to gas. April 9; six months.

William Galloway and John Galloway, of Manchester, Lancaster, engineers, for improvements in steam engines and boilers. April 14; six months.

Samuel Holt, Chester, manager, for certain improvements in the manufacture of textile fabrics. April 14; six months.

John James Greenough, now residing in Washington, America, Esq., for improvements in obtaining and applying motive power. Communication. April 14; six months.

David Christie, of No 3, St. John's place, Broughton, Salford, Lancaster, merchant, for improvements in machinery or apparatus for preparing, carding, spinning, doubling, twisting, weaving, and knitting cotton, wool, and other fibrous substances; also for sewing and packing. (Communication.) April 14; six months.

Benjamin Guy Babington, of Hanover-square,

Middlesex, doctor of medicine, for improvements in preventing incrustation in steam and other boilers. April 16.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, Middlesex, engineer, for improvements in the manufacturing and refining sugar, and in machinery and apparatus used in producing a vacuum in such manufactures, and which last improvements are applicable for exhausting and forcing fluids. April 17.

Thomas Hill, residing at Langside-cottage, near Glasgow, Renfrew, Scotland, Esq., for certain improvements in wrought iron, or malleable iron railway chains, and in the machinery or apparatus employed for producing the same. (Communication.) April 17.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Andrews, of George-street, Westminster, mechanic, for certain improvements in steam engines, and in boilers, in pumps, in safety valves, and in wheels and axles. April 24; six months.

William Smith, of Snow-hill, London, gas-meter maker, and Thomas Phillips, of Brighton, gas fitter, for certain improvements in apparatus for heating, ventilating, and cooking by gas. April 24; six months.

Robert Hawkins Nicholls, of Pimlico, Middlesex, gentleman, for improvements in machinery for giving motion to agricultural and other machinery. April 24; six months.

Joseph Clinton Robertson, of the firm of J. C. Robertson and Co., of 166, Fleet-street, London, patent agents, for improvements in musical instruments. (Being a communication.) April 24; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
April 16	2780	G. D. Alderson and Co.	Blenheim-street, Oxford-street.	Podenomic refrigerator.
17	2781	T. Edington and Sons	Glasgow	Self-acting hot-air range.
,,	2782	J. Welsh and J. Margetson	Cheapside	The European cravat.
,,	2783	Parker and Acott	Birmingham	Everpointed magnum-bonum pencil.
22	2784	L. Hicks	Leeds	Hat.
23	2785	C. Hodges	Devon	Ribbon protector or reel.
,,	2786	H. and W. Turner	Sheffield	Cyma-rector fire-irons.
,,	2787	T. Glover	Suffolk-street, Clerkenwell	Gas-light economic regulator.
,,	2788	H. C. Hurry	Manchester	Sheet glass for covering buildings.
,,	2789	I. Martin	Killyleagh-Mills, Down, Ireland	Flax-dressing holder.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

April 15	165	S. Charles	Calthorpe-street	Apparatus for cooling and freezing.
,,	166	S. Lowry	St. John-street-road	Dead seconds watch.
17	167	R. Howson	Manchester	Packing-ring segment for piston safety-valve.
,,	168	R. Howson	Manchester	Packing-ring segment for piston safety-valve.
,,	169	E. Dove	Forster-street, City-road	Safety envelope.
19	170	W. W. Nicholson	Newark-upon-Trent	Cooking stove.
,,	171	C. Bolton	Dorset-street, Portman-square	Stitching machine.
,,	172	C. H. Moysen	Calthorpe-street	Irrigator to be worked by hand.
22	173	J. E. Townshend	St. George's-place, Camberwell	Invalid's bedstead.
,,	174	S. Cox	Walsall	Albert stirrup and stirrup leather.
,,	175	S. Cox	Walsall	Draw-mouth clipper bit.
23	176	A. Blenkinsop	Waterloo-road	Galvanic rod.
,,	177	Chadburn, Brothers	Sheffield	Barometer tube.
,,	178	J. F. C. Noel	Calthorpe-street	Bit.
,,	179	A. E. Loradoux	Calthorpe-street	Pencil cutter.
,,	180	C. H. Moysen	Calthorpe-street	Irrigator for making furrows or trenches of fixed dimensions to water the land.

CONTENTS OF THIS NUMBER.

Description of Gwynne's Patent Double-Acting Balanced Pressure-Wheel—(*with engravings*) ... 321
The Atlantic Steamers ... 324
M. Foucault's Ocular Demonstration of the Rotation of the Earth ... 325
Speed and Power.—Reply to Mr. Frost ... 329
Description of Martin's Registered Flax-Dressing Holder—(*with engravings*) ... 330
Description of a Buoyant-Masted Life-Boat. By Mr. Firmin—(*with engraving*) ... 331
On Coloured Photographs and the Hillotype. By Mr. B. Hunt ... 332
Further Communication from Mr. Hill ... 333
Patent Law Reform—The Government Bill ... 333
Specifications of English Patents Enrolled during the Week:—
Young ... Paraffine ... 334
Michiels ... Potatoes ... 336
Barlow ... Cotton Spinning ... 336
Fowler ... Steam Engine ... 337
Harding ... Flax ... 337
Baddeley ... Earthenware ... 338
Williams ... Buttons ... 338
Shears ... Sugar ... 338
Johnson ... Colors ... 339
Rose ... Guns ... 339
Monthly List of Scotch Patents ... 339
Weekly List of New English Patents ... 340
Weekly List of Designs for Articles of Utility Registered ... 340
Weekly List of Provisional Registrations ... 340

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MR. GRANT'S PATENT STEAM BOILER.

MR. GRANT'S PATENT STEAM BOILER.

(Patent dated 24th October, 1850. John Grant, of Hyde Park-street, Esq., Patentee. Specification enrolled 24th April, 1851.)

Specification.

My invention consists of improvements in furnaces and apparatus used for heating water or other fluids in boilers or vessels, for the purpose of better regulating the application of the heat and the temperature of the fluid, as well as economizing the fuel employed.

For this purpose, I construct my furnace and its flues, as well as the boiler to be heated, in such manner that they, the furnace and flues, are surrounded by or immersed in the fluid to be heated, and in this way I am enabled to obtain a large portion of heating surface.

In order to ensure a continuous supply of fuel to the furnace, I place a cylinder or tube immediately above the grate of the furnace, and in this cylinder is kept such a store of coal or other fuel employed as will keep the furnace constantly and regularly supplied with the requisite quantity of fuel.

The furnace grate I prefer is made of a conical form, the point of which projects upwards, so that the fuel may gradually descend or be forced towards the periphery of the grate to supply the place of that which shall be destroyed by the combustion. Immediately above the periphery of the grate I make a circular flue surrounding the receptacle for fuel, and extending up into the boiler as far as conveniently may be, but leaving a space between the flue and the receptacle for fuel, into which a portion of the water or fluid to be heated may be admitted by tubes passing through the flues.

At or near to the top of the circular flue I insert tubes or pipes, by means of which the gaseous products arising from the combustion in the furnace may be carried into the chimney; and the greater distance those tubes pass through the fluid to be heated, the more effectually will the caloric evolved by the combustion be absorbed, and the waste of it thus prevented.

The ash-pit under the grate of the furnace is closed, but furnished with a door or doors, by the more or less opening or shutting of which the supply of air to the furnace may be regulated at pleasure.

The regulation of the supply of air to the furnace will not only govern the amount of fuel consumed, but also regulate the temperature employed in heating the fluid; the reservoir of fuel at all times containing such a store as may be needful for keeping up the combustion.

When the furnace is in operation, and the process of heating a fluid in the surrounding boiler or vessel is going on, the heat of the circular flue will raise the temperature, and therefore diminish the specific gravity of the small portion of fluid in the space between the flue and the fuel reservoir so quickly, that there will be a constant current of fluid up through that space; and in this way the greater, if not every portion of the fluid will be made to come in contact with the heating surface by which it is to be heated.

The figure (prefixed) shows the manner in which furnaces and apparatus for heating fluids according to my invention may be constructed. It is an elevation, partly in section, of a boiler, with a furnace and apparatus constructed according to my invention, the whole being placed upon a proper seat of brickwork; a front view of which, and of the doors of the ash-pit, is shown in the figure.

A A is the boiler or vessel containing the fluid to be heated; B B is the seating of the brickwork, upon which it is placed; C is a conical grate, below which is an ash-pit made in the seat of the boiler, the front opening in which in the brickwork is capable of being more or less closed by the two sliding doors *b b*.

The grating is furnished with projecting legs, by means of which the grating is not only held in its proper place, but also kept at such a distance from the surrounding brickwork and boiler as to leave a small space for the passage of air up into the fire.

D is the reservoir for fuel, which is to be kept always charged with a sufficient quantity of the description intended to be used.

E E is a circular flue (being the space between two cylinders, one placed within the other and inclosed at top) surrounding the fuel chamber D, between which and the flue is a small space *f f*, into which the fluid to be heated is admitted by short tubes *a a* passing through the flues.

F is a pipe or tube, by means of which the gaseous products of the combustion are carried off into the chimney.

The fire being lighted immediately above the grating, the heat arising from it will ascend into the flue E E, and heat the liquid in the boiler A A, and the heat will cause a current of the fluid in the boiler to pass through the short cross tubes *a a*, and up through the space *f f*, and over the top of the flues into the boiler A A, in the manner already described.

As the fuel round or near to the periphery of the grating is destroyed by combustion the weight of the superincumbent fuel in the chamber D, will cause a fresh portion to take its place, and the rapidity with which the combustion is carried on may be regulated at pleasure by admitting a greater or less supply of air through the ash-hole to the burning fuel.

In this way the heating of the fluid in the boiler may be regulated at pleasure, and it may be made to boil, or the temperature may be kept as much below the boiling point as may be thought fit.

So, on the other hand, if the boiler to be heated should happen to be a close boiler, and used for a steam engine, or any other purpose, by admitting a greater supply of air to the fire, the temperature of the fuel may be raised to the desired point.

DESIGN FOR AN INDUSTRIAL SCHOOL.

It will be admitted that education of the industrious classes should be as cheap as can be made consistent with affording the amount of instruction required; and that the minimum of cost does not depend on the engagement of teachers at low salaries, but on other circumstances, amongst which an important one is, the selection of such instructors as are really competent, and the making it worth their while to exert themselves in the onerous, but meritorious duty confided to them.

Many are the masters who look upon the self-satisfaction of having done their duty as going far towards a compensation for their exertions; but speaking humanly, *pecuniary* reward is the master's due, and should, as far as practicable, be made to depend on his success in tuition; and success is actually measured in all schools by the greater or lesser number of children who, under different masters, attend them. When the professor in a higher school is successful in his teaching, the students are numerous; in national schools it has been seen, that when a change from a competent master or mistress has been made for one less able, the number of children has fallen off perhaps a third; which indicates that a weekly payment for each child attending school would be a more appropriate and eligible mode of remunerating the master than a fixed salary could be under any circumstances, even where wholly eleemosinary education is afforded. In a former communication (*Mech Mag.*, No. 1431), where the object was to exhibit that an excellent industrial education might be afforded for 6d. a week from each scholar, the pay to masters was set down at fixed annual salaries, as most accordant with usual custom; but supposing the total sum received from pupils to be the same as therein calculated, instead of fixed salaries, the weekly payments might be better divided in fixed proportions, amongst the head master and his several assistants. This is an old arrangement of Sir Samuel Bentham's, and it formed the basis of a plan sanctioned in the year 1806 by the Emperor Alexander of Russia, for a school of 1,000 pupils, for the naval service of that country; it is partially acted on at King's College, and might easily be arranged for all schools where the direction of them is vested in others than a private proprietor of each one.

A powerful mean of reducing the expense of education, is that of so arranging tuition as to afford it with the smallest possible number of highly skilled and

proportionately-paid instructors. In discussing this question, small village schools are necessarily excluded, and infant-schools, national schools for boys, and national schools for girls, will be instanced as examples, because they and the names of them, are familiar to the public.

The bringing together under one head master all the children of the infant-schools, and the national school for boys, and girls, could not but be productive of great economy, and of many other important advantages. The amount of remuneration that could be afforded to a single head, instead of three masters and mistresses, would enable superior talents to be engaged for the chief direction and more advanced instruction, whilst subordinates, male and female, each competent to their respective duties, might be engaged at comparatively small pay; pupil and other juvenile teachers, for example, might under his supervision be extensively employed.

A prominent improvement which would result from the bringing into one school those now in three distinct schools, would be the facility afforded of dividing the children into many classes, according to the tripartite system of the Government Inspector of Schools, the Rev. H. Mosely, and which, amongst others of its advantages, has the great one of giving each child the place it merits in some one superior class, though it may be deficient in the knowledge requisite in other branches of education, and thus avoiding discouragement.

The bringing together many hundred children may be objected to, though it seems to succeed well in the higher ranks of life at the most esteemed schools of England,—for example, Eton, and the High School, Edinburgh: as to difference of age, it is not wider between the three years of the infant and the thirteen of the national scholar than it is between the child of seven and the lad of seventeen at Eton; nor are ideas more different in the one case than in the other as resulting from difference of age.

The joining boys and girls together in the same school is likely, at first sight, to be considered indiscreet. Boys, it will be said, are by nature unruly and boisterous — they would encourage the girls in disobedience—it would be immoral to bring the two sexes thus together. In answer, it may be asked, if one important object of education be not to conquer unruliness in boys as well as girls, and to bring under controul any mischievous excess of vivacity? Whether girls be present or not, the master of a school is little competent who cannot keep his pupils quiet. In the school at the Hague—described as so very superior to English schools for its quietude and order—hundreds of boys and girls are instructed together. In point of fact, girls are not less prone to disobedience than are boys. And as to the immorality of giving instruction to the two sexes in the same school, it is not there that disorder need be apprehended. Nor is it the usage of Protestant society to separate boys and girls by day anywhere but in school, more especially in the middle and inferior ranks. Boys and girls are together in the nursery; they partake together of the family meal; they are together at the infant school; they afterwards are together on the way to a daily school; they pray together, whether at home or at church. It would seem, according to present practice, as if the air of a school—it can be nothing else—were looked upon as a source of moral contamination, since in no other place are boys and girls separated. It has been remarked in private life that where, in a gentleman's family, the boys and girls have been educated together, the boys have lost their turbulence, or rather have never acquired it, whilst the girls have gained from their more sturdy comrades a most useful amount of self-dependance and of power of action, in the dangers and difficulties to which we are all of us at times exposed. The same result may be hoped for were children of both sexes educated together in an industrial school; and the habits of decorum there acquired in their intercourse with one another, would beneficially influence their conduct in after life. So modesty of thought as well as of demeanour is more likely to result from such habitual association in schools than from separation, since the latter too often leads a child to ponder on the reason for it, and to indulge after school hours in a vicious turn of mental association which otherwise might not have entered into the juvenile mind. Separation of this kind has the further mischief of exciting a taste for forbidden fruit, conceived to be delicious only be-

cause forbidden—not for intrinsic value. Frequent are the complaints that boys and girls, on leaving ragged schools, seek out each other, and early immorality ensues; so in a populous place in the environs of London, a place where the clergy and the inhabitants devote much time and care to the well ordering of schools, the girls, on leaving the national school, instead of playing with other girls, often run after and attack the boys. Worse could not be, under the worst conducted school where boys and girls might be instructed together.

The value of the tripartite system is greater and greater, the more the number of pupils, and diversity in their acquirements is increased; hence the desirableness of combining infant schools with those for elder children. This system is a source of economy, inasmuch as in the lowest class, for instance, and so of other classes, the teacher in each needs know little more than what has to be taught the pupil; hence monitors and pupil-teachers may be extensively and efficiently employed. As to the children themselves, it is found that many in the infant school are further advanced in some branches of education than those of the lower classes in a national school, yet must, to their great discouragement, be placed in the lowest class on entering it.

Preceding papers in the *Mech. Mag.* have indicated that useful science should be taught habitually to children of the middle ranks and to those of the industrious classes. A certain amount of scientific instruction has been given with the happiest effect in the national schools at King's Somborne; but it does not appear to have been at the same time to both boys and girls. The truths of science being the same for the boy as for the girl, lectures on them need be nowise different for the two sexes, and might as well be heard by hundreds of children at once as are lectures at the Royal Institution by an audience of hundreds of the gentry. As in other branches of instruction, the pupils would require separation into classes according to advance in knowledge. It were waste of a child's time to oblige it, year after year, to listen to the A B C of science, as of literature. It would, indeed, be more than indecorous to assemble youths and maidens in a school of medical anatomy; but even in this science, as much of it might be taught, without indecency, to boys and girls together, as would give a general knowledge of the human frame, especially such parts of it as are most exposed to injury in the ordinary occupations of the industrious classes, to which might be added the precautions to be taken to diminish danger. A smattering of medical science is generally mischievous to its possessor; the best lecture on this branch would, therefore, be made up of reasons why private *doctering* should be abstained from.

That learning, and school itself, should be rendered pleasurable, is highly conducive to the success of education; but this does not imply that tuition should be made a play, or that instruction should be held out to the scholar as a mere amusement. Far from it, since one of the most important lessons children of all ranks have to learn is, that of the need of application, and of the attainment of a power to command attention for a prescribed length of time. Hence it may well be doubted whether the games sometimes introduced as instructive, be not, in fact, prejudicial; but experiments explaining or proving a fact are not games, and interesting a child in them is not teaching it to gamble; suiting the length of application required to the age and abilities of a child is not inducing unsteadiness. The effect of different lengths of application was lately exemplified in a well-managed infant school; the lessons given in it never exceed twenty minutes in length. At a late examination, the children's progress in arithmetic was seen to be remarkably great, as many of them answered questions in the four first rules without a fault; but their proficiency led to a prolonged examination, and by the time it had lasted half an hour the children were exhausted and became erroneous in their replies.

A most desirable adjunct to a school would be a provision for affording temporary employment for the pupils after they had left it, since it rarely happens that they can immediately be placed in permanent situations. The scheme has already had a fair trial and with the best results. Girls have been furnished with needlework at prices below those of regular sempstresses, though superior to slop-shop payments, as the work was

required to be good and strong, but the pay was never sufficient to act as a temptation to forego regular employment; thus competition with sempstresses was avoided, as it was with shopkeepers by the arrangements that were made for selling finished articles of apparel. There was nothing in the way of profit on the work, and very little loss. Were some such plan adopted it might be under the immediate management of some discreet woman who could judiciously controul the young sempstresses without imposing unnecessary restraint. It might be more difficult to provide suitable work for lads, though equally desirable; possibly some common carpentry might be made available, also nail-making, basket work, common shoe-making, &c. Preliminary industrial education in the school would have prepared the lads for employing themselves beneficially instead of loitering away their time in idleness.

Existing school buildings might in most places be made to serve, though the three schools were combined; for if not under the same roof at present, the most appropriate of the three structures might have a story or more added to its height, and the interest of the money laid out on the alteration could hardly amount to so large a sum as would be saved in salaries to masters and mistresses. Where new schools have to be erected, and many are in contemplation, it might be well to consider whether the accustomed form and distribution of school buildings be really conducive to economical tuition. Difficult as it is to quit an old beaten track and strike out into a new one, still the panopticon principle seems the most worthy of adoption for schools, as for manufacturing and many other purposes. The necessity of inspection is universally admitted,—inspection of the subordinate teachers in a school no less than of the scholars; and these desiderata are attainable in a Panopticon with greater facility, certainty, and at a less expense than in any other form of structure that has been hitherto devised. Buildings supposed to be on this principle have been erected and have failed, but that failure has arisen from a deviation in internal arrangements from the distinguishing feature of a Panopticon; namely, inspection from a central station of every compartment into which a structure may be divided.

A Panopticon with radial wings, as described in No. 1338 of the *Mechanics' Magazine*, would be too immense for a village or even a town school; not so a structure such as that originally devised.* It was a circular building, well lighted by windows round it, and divided into several radial compartments, but which terminated short of the centre. The central post was enclosed with glass, as a chamber for the superintendent from which he could inspect and controul the several compartments that surrounded him. For buildings of this kind, consisting of several stories, the inventor of the Panopticon (Sir Samuel Bentham) contrived a lift, on which the inspector's chair was placed, and seated in which, by the help of a simple counterpoise apparatus, he could raise himself to a level with any of the upper floors. Supposing a building on this principle to be adopted for a school on the tripartite system, some such appropriation as the following might be arranged for its several floors and their compartments.

Basement, having an open area round it; kitchen, scullery, wash-house and other accommodations for laundry-work, coal-cellar, and apparatus for warming and ventilating the whole structure.

Ground floor.—Entrance hall, communicating with an annular passage round the head master's glazed office, giving entrance to the several compartments, staircase communicating with annular passages on each of the upper floor compartments, room for hanging up, drying, and ventilating cloaks, great coats, &c. The compartments on this floor might be appropriated as workshops, wash-rooms for school girls, and for elder ones, should the above-mentioned project for usefully employing them be adopted.

First floor.—Compartments for different classes in writing, drawing, arithmetic, &c., for which lined desks or apparatus is required.

Second floor.—Apartments for the head master, other masters and mistresses, and such pupil teachers and assistants as might be lodged in the building.

Third floor.—Lecture-room, library,

* See for an account of it, and the purposes to which it is particularly applicable, vol. ii. of the works of Jeremy Bentham. Also *Mech. Mag.*, No. 1338, for many details on the subject.

repository for simple scientific apparatus, reading-room.

Fourth floor. First instruction in reading, baby nursery.

Roof. Flat, as an airing-ground for babies and very young scholars.

By the above arrangements the private apartments are, for the sake of quietude, interposed between the floors where the more silent studies are located. Babies might safely and easily be taken up and down by means of a cradle-lift; for children having well the use of their limbs, the running up and down a flight of stairs on changing from one branch of instruction to another, would be a healthful stretching of their joints and muscles, and would afford a short relaxation of mind without causing positive idleness. But though a particular arrangement of the building has been indicated, it has only been in the way of general suggestion. So that the principle of the Panopticon be adhered to, details and dimensions admit of great variety and modification; even in the segment of a circle inspection might be provided for, as was proposed in the plan of an academy for the gentlemen cadets at Woolwich. *Mech. Mag.*, No. 1338.

A building of a circular form, or a polygon of many sides approaching to the circular, is the least costly mode of structure in proportion to the space enclosed within its walls; its appearance is graceful, and the monotony of the circle admits of relief by the projection of a portico for example, and which for a school might form the entrance-hall. For whatever purpose a building might be erected where *public* inspection might be desirable, the Panopticon affords means of according it without interruption of the business of the place. By admitting visitors to the central inspection-room, they would witness all that was going forward in the several compartments of the several floors without the least disturbance to pupil or teacher; and thus the good effects of public examinations would be obtained free from their mischievous ones; such as the preparation of a few clever children to show off on the occasion, whilst others less apt, but equally deserving of care, are too frequently neglected.

M. S. B.

THE RECEIVED METHODS OF CALCULATING "DISPLACEMENT."

Sir,—In Mr. Fincham's "History of Naval Architecture" Introduction, p. 45, I observe the following foot note, "It is doubtful whether the method now used for calculating the cubic contents of the body gives the exact measure." This is appended to the author's remarks on the methods now in use of approximating to the solid contents of the body of the ship and the portion of its centre of gravity, in other words the displacement of the centre of buoyancy. This observation is calculated to discredit a method which has for many years been employed by many eminent scientific men, to whose labours naval architecture is much indebted for its present position in this country. Amongst others I may mention Dr. Inman and Mr. Creuze. The former of these gentlemen not long ago published a small work, the sole object of which is to elucidate the application of Simpson's rule to the calculation of the displacement, &c., and to improve on the ordinary method by diminishing the intervals between the sections in those parts of the ship where the change of curvature is rapid. I have myself bestowed some thought on this subject, and have fully satisfied myself that the method called in question in Mr. Fincham's work is essentially correct, especially with the improvements recommended by Dr. Inman. A very grave responsibility lies upon Mr. Fincham or his mathematical advisers for hazarding such an assertion, which cannot fail to influence many practical men, unless there be some strong ground for making it. No reason of any kind is, however, given in the work. I will now state to the mechanical world, with your kind permission, some reasons which seem to me to place the value of this method beyond a doubt.

If A be the area of the figure contained between a curve, a straight line, and two extreme ordinates a and b; and if h be the portion of the straight line intercepted between these ordinates; taking the foot of the first ordinate for the origin of co-ordinates

$$A = \int_0^h y dx,$$

x and y being the co-ordinates of any point in the curve.

If $y=f(h)$ or the curve be a regular curve,

Then

$$A=\int_0^h f(h)dx$$

may be found by integration. If, however, the curve be irregular; it is abundantly proved that if h be divided by an odd number of ordinates into an even number of equal spaces, Simpson's rule (a proof of which appeared in No. 1443 of your valuable Magazine) gives the area with a great degree of exactness—if the ordinates be taken sufficiently near to one another. And it is evident from the form of the expression,

$$H=\int y dx,$$

that any other quantity which may be put in the same form may be integrated approximately by the same rule; the only limitation being, that the ordinates shall depend for their value upon no other variable than the quantity represented by x. It is on this principle that mathematicians, especially continental writers, have employed this rule in finding approximately the space described by a body in a given time, moving with a variable velocity—the work developed through a given space by a force varying in intensity from point to point—the horse power of a steam-engine, the steam pressure varying from point to point of the stroke—and other quantities of the same kind. Indeed, the method may be said to be as old as Newton, who has employed at least the principle of it in the solution of his ninth Lemma.

Now if V be the volume of a solid contained between three planes mutually at right angles and planes parallel to two of them, and a curve surface,

$$V=\iint z dx dy,$$

where x, y, z, are the co-ordinates of a point in the surface, the given planes being taken for the planes of xy_1, xz_1, and yz. If the surface be regular or $z=f(x_1 y)$, then

$$V=\iint f(x_1 y)dx\,dy$$

may be found by a double integration.

To effect this, we will first suppose x constant, then

$$\int f(xy)\,dy$$

will give the area of the section parallel to the plane of yz at the distance x from the origin. The values of y at the limits, which will depend on the nature of this section, will be generally functions of x, whence

$$\int f(x,y)\,dy$$

may be represented by X (a function of x) and

$$V=\int X\,dx:$$

This being integrated with regard to x between the proper limits, gives the volume. The integration with regard to y having been effected, it is essential to observe that the quantity then to be integrated is exactly of the same form as

$$A=\int y dx;$$

and therefore the same observations that applied to the latter apply to it also.

If, however, the surface be not regular, still considering x constant, we may find the value of

$$\int z\,dy$$

by the method of equidistant ordinates, and thus find X; and if this be done for each section corresponding to the intervals into which x is divided, we shall have, in order to integrate X dx, a series of quantities exactly analogous to the values of y in the expression for the area

$$A=\int y\,dx,$$

dependent, *i. e.*, on no variable but x for their values. It is then evident that Simpson's rule is applicable not only to find the values of the various sections represented typically by

$$\int z\,dy,$$

but further to find the sum of all these, *i. e.*, the volume of the solid. A little reflection will satisfy any one of the complete analogy of the operations.

Further, a new mode of finding the displacement by a single operation, from the ordinates only, which you published in No. 1443 of the *Mech. Mag.*, and which is quite independent of the ordi-

nary method, is valuable from the wonderful agreement of the results obtained by it with those obtained by Simpson's rule; and wonderful this agreement would certainly be if the ordinary method were not to be depended on.

In the investigation of that rule I supposed a paraboloidal surface to pass through the extremities of six ordinates to the surface, and calculated the volume between the surface, two of the co-ordinate planes, a plane parallel to the third, and a fourth plane inclined to two of the bounding planes and perpendicular to the other. In this process I neglected the volume *between the two surfaces*, as inappreciable, exactly as the interval between the parabola and the curve is neglected in the investigation of Simpson's rule. It is evident that if the ordinates are taken sufficiently near to one another, this is a correct assumption. The rule for finding the volume so obtained is not only remarkable for its simplicity, but has in many cases—some of them large vessels, one of upwards of 5,000 tons' displacement—given results agreeing admirably with those derived from the ordinary method. In the vessel of 5,000 tons—a 120-gun line-of-battle ship—the agreement was within a small decimal of a ton. In another case, that of a large steam frigate, the displacement being upwards of 2,700 tons, it was remarkable that there was a difference of 10 cubic feet between the volumes given by vertical and horizontal sections; and the new method gave a result exactly intermediate between the two, five cubic feet more than one and less than the other, differing from each only by one-seventh of a ton.

In conclusion; I beg to express my decided conviction that, if in any instances there has been reason to believe that the calculated displacement differed much from the real displacement (though nothing of the kind is asserted in the work in question), the error must be sought not in the rule, but in the application of it, which may very frequently be justly considered incorrect and slovenly.

I am, Sir, yours, &c.,

JOSEPH WOOLLEY.

Her Majesty's Dockyard, Portsmouth,
April 29, 1851.

SCREW PROPELLING.

Sir,—It appears to be a general, and, in my opinion, an erroneous doctrine, that the most favourable results in *screw propelling* are to be obtained from small angles, or low pitches—in the form of the propeller. I have always maintained that there can be no loss of power, whatever may be the angle (within certain limits), but that a greater angle than that which is usually given will produce the *same* velocity in fine weather, with *fewer* revolutions of the screw; and whilst steaming against adverse winds will be found still more conducive to the realization of *propelling* power, with the smallest expenditure of *engine* power.

These views have already been amply supported by the cases of the *Great Britain* and *Princeton;* but the publication in your 1442nd No., of experiments in the *Dwarf* with screws of various angles and the same diameter, has afforded the most convincing proof possible of the truth of what I have advanced. Unfortunately most experiments in screw-propelling are referred to the vicious standard of *apparent* slip—a method which can only perpetuate error; but in the *Dwarf* experiments the *actual horse-powers exerted* are likewise given, by which means correct conclusions can be arrived at.

1. With an angle of 24 °12.′, a speed of 9·11 knots was obtained with an expenditure of 168·8 horse-power.

2. When the angle was increased to 30.°6′, with a screw of similar diameter and area, a speed of 9·05 knots was obtained with an expenditure of only 154 horse-power, and a reduction in the revolutions of the screw, of more than (⅕) *one-fifth.*

There can be no stronger proof than these experiments of the superiority of the long pitch; but the *apparent* slip is stated in the first case to be only 30·4 per cent., whilst with a much smaller power, producing the same velocity, it was 36·8 per cent. Any theory therefore which is founded on the apparent slip of a screw must be false, and of no practical use. I could comment upon experiments with the screw of different areas, which are likewise connected with the preceding experiments; but at present I beg to remain your obedient servant,

W. GORDON, Lieut. R.N.

London, April, 9, 1851.

MILLINGTON'S PATENT CORN AND FLOUR-CLEANSERS.

(Patent dated 24th October, 1850. Patentee, Mr. Bryan Millington, of the firm of Millington and Sons, Newark-upon-Trent. Specification enrolled 24th April, 1851.)

Fig. 1.

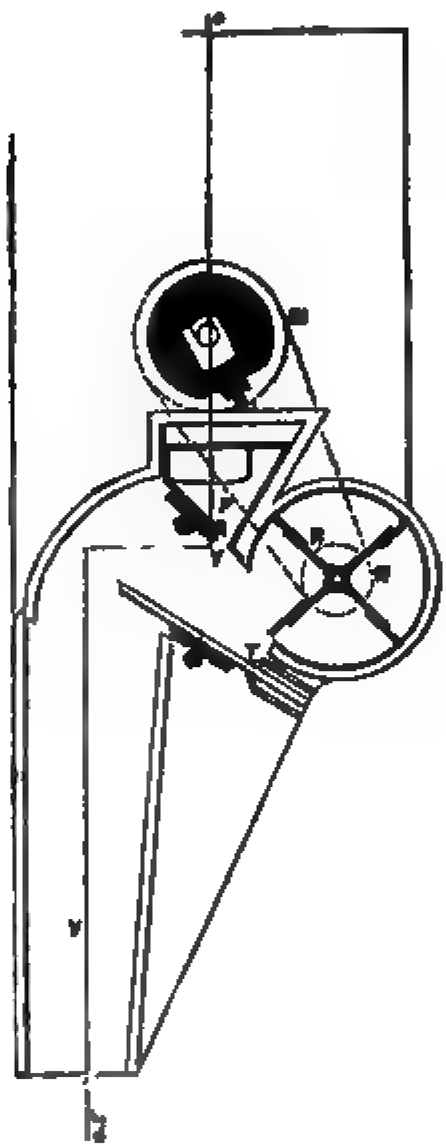

Fig. 2.

Specification.

Figures 1, 2, and 3 of the engravings represent a corn-cleaning machine constructed according to my improvements; fig. 1 being a transverse section of the same on the line *ab*; fig. 2 a longitudinal section on the line *cd*; and fig. 3 a transverse section on the line *ef*. A is a hopper to receive the corn to be cleaned, and from which it descends into the conductor D through the aperture *b*. E a gauge for adjusting the size of the aperture *b* to the quantity intended to be passed through. E^1E^1 openings through which the corn passes from D into a conical screw K. F driving drum. G main shaft or spindle of the screen. HH radial arms which are attached to the spindle G, and carry the brushes, which are formed of longitudinal bars *aa* of wood or iron, and filled with wire in the same manner as common brushes made of hair or fibre: or, the wires may be inserted into leather or other suitable substance, and then mounted upon the bars. K frame of the conical screen; L opening from the screen into a small receiving hopper P. M is a pulley on the main shaft, from which the fan-blower R is driven by a band passing over the pulley N. O the spindle of the fan-blower. Q a slide formed with a rack and pinion by which the size of the passage out of the small hopper is regulated. T corn spout. W a box containing the conical screen. XX bearings for main shaft. Y glass spy-hole, through which the small hopper gauge at bottom may be inspected; and ZZ flanges to carry the screen. The mode of using the apparatus is as follows:—

The corn or grain to be cleansed is put into the hopper A, from which it descends through the aperture *b* into the

conductor D, whence it falls into the conical screen through the openings $E^1 E^1$, where the revolution of the brushes I I disengages the smut and dirt which may be adhering to or intermixed with the grain. (I consider a good speed for the brushes to be about 800 revolutions per minute.) The smut and dirt fall through the wove wire covering of the screen into the spout V, while the grain gradually finds its way down the incline of the cone into the receiving hopper P, from which it descends in front of the fan-blower, being during its descent, thoroughly cleansed from any dust or other light substance that may still be intermixed with it; and finally it falls through the spout I, while the extraneous matters separated by the fan are discharged through the spout U.

The machine described is partly applicable for dressing flour, but when em-

Fig. 3.

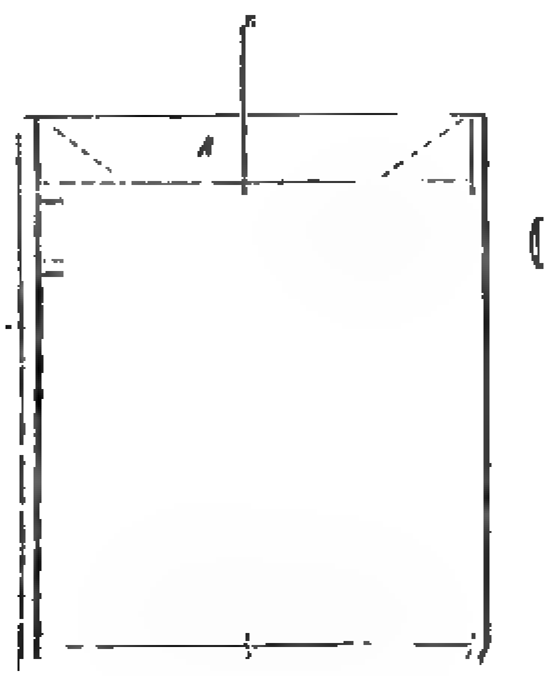

Fig. 4.

ployed for this purpose I dispense with the fan-blower, and prefer placing the case in an upright position; but it may be laid horizontally, or at angle, if required.

Fig. 4 is a vertical section of a flour-dressing machine on the same principle.

AA is the wire-gauze case, which is made of a conical form, like the screen of the corn-cleaning machine before described. BB are the brushes, which are of the common sort used in flour-dressing machines, but placed upon the arms at such an angle with the main-shaft C, as shall correspond to the sides of the conical case. D is the lower bearing or step of the shaft which is capable of being raised or lowered at pleasure by means of the screws EE, and which of course raises or lowers the shaft and brushes along with it. By this arrangement the brushes may be moved closer to or further from the wire gauze covering of the case, even while the machine is in motion, thus enabling them to be so placed in relation to each other that they shall produce the most effective dressing of the flour. F is the upper bearing, and G the hopper into which the meal to be dressed is placed, and H a spout through which the meal is fed into the case A. I is the feeder which is composed of one or more pins KK inserted into the upper end of the spindle or shaft C. The continuous revolution of those pins keeps an uniform flow of the meal from the hopper, unattended with the noise produced by the feeders now in general use; for which reason I have called them "silent feeders." The dressed flour as it issues through the wire gauze covering of the case A, is collected in the same manner as from the tables now combined with flour-dressing machines with cylindrical cases.

Claim. — 1. The corn-cleaning machine, before described, in the peculiar construction, arrangement, and disposition of parts of which the same consists, that is to say, in so far as regards the making of the wire gauze, or perforated metal case of the shape of the frustum of a cone, the employment of wire brushes made as described, the placing of the receiving hopper R at the outlet of the frustum of the conical screen, with the gauge to regulate the quantity of corn allowed to pass in front of the blower, and the spy-hole by which the said gauge is inspected.

2. The making of the wire gauze, or perforated metal screen of flour dressing machines in the shape of a frustum of a cone, and the means of regulating the distance between the sides of the screen and the brushes, both as described.

3. The silent feeder, as described.

THE ROTATION OF THE EARTH.

Sir,—There exists a good deal of misapprehension in reference to the important pendulum experiment of M. Foucault, as is sufficiently obvious from the correspondence now going on in the newspapers. I beg to offer to your readers the following simple explanation of the phenomenon:—

Let there be a horizontal line in the plane of the meridian, over which line let the pendulum hang, the bob being vertically over a point P, when at rest, that is, before it is made to oscillate.

If this line be prolonged it will meet the prolongation of the earth's axis, and will form an angle with it equal to the latitude of the point P.

In revolving about the axis of the earth, the horizontal line will generate a conical surface, the axis of the earth being the axis of the cone.

The point P, immediately under the bob, rotates *slower* than the points in the same line more remote from the apex of the cone; so that if the bob be made to sweep over these points, they must proceed in advance of the bob, since the rate of rotation of the bob must be the same whether it oscillate or not; this is plain, because its oscillation cannot interfere with any motion of revolution round the cone it may have had when hanging freely. This is sufficient to establish the fact that the path of the pendulum must appear to be gradually receding from the meridian, making with it an angle of deviation which becomes larger and larger at every oscillation.

Let us now seek to determine the time in which the pendulum describes a complete circle on the horizontal plane.

As the absolute direction of the oscillations remains invariable, when the cone has turned through any angle, the original horizontal line must (apparently) have turned through an *equal* angle, so that when the cone has made a complete rotation, the deviation of the path of the bob from the horizontal line amounts to an angle equal to the angle of the cone. This can never amount to so much as 360°, or a complete revolution, except when the bob is suspended over a pole of the earth, the conic surface then becoming simply a *plane*, tangential at the pole. Proceeding from this extreme limit towards the equator, the angle of the cone becomes less and less, till, on reaching the equator, it vanishes altogether; the cone then becomes a cylinder, and no deviation can take place.

From what is now shown, it follows that the angle of deviation in any time, at any place, is a plane angle exactly equal to the development of the corresponding conical

angle turned through in that time by the rotation of the cone. It remains to be ascertained what part this angle of deviation is of a complete circle, or 360°. In other words, we have to ascertain what part of 360°, the angle at the apex of the cone, amounts to. Conceive an upright cone; and from the apex let any two straight lines be drawn along the slant side, intercepting an arc of the base; this arc will measure a certain angle at the centre of the base. Measure from the apex, along either of the two lines drawn from it, a length equal to the radius of the base, and describe with this length, as radius, a circular arc on the cone; this arc will measure the conic angle; it will therefore be to the corresponding arc of the base as the angle at the apex to the corresponding angle at the centre of the base; but these arcs are also to one another as their distances from the apex; hence the conic angle is to the corresponding plane angle as the radius of the base to the length of the slant side, that is as the sine of half the angle of the cone to unity. Consequently, the whole conic angle is to 360° as the sine of half the angle of the cone, that is, as the sine of the latitude, is to unity. Hence, from what is shown above, the angle of deviation of the path of the bob in one entire revolution of the earth, is to 360° as the sine of the latitude to unity. The *time* of this revolution is 24 hours, hence 24 hours divided by the sine of the latitude is the time in which the path of the pendulum makes a complete revolution in that latitude. Thus, assuming the deviation to be 360°, we have, by the above theorem, $160° = x$ sin. lat.

$$\therefore x = \frac{360°}{\text{sin. lat.}}, \text{ in } \textit{degrees},$$

$$\therefore x = \frac{24h}{\text{sin. lat.}}, \text{ in } \textit{time}.$$

I feel it to be but just to add that the above mode of considering the phenomenon by aid of *the cone of latitude*, as it may be called, is substantially the same as that suggested by a correspondent ("J. M. H.") in the *Times* of Tuesday, April 29; but I had previously given the same explanation to several persons; and Mr. Sylvester can bear me out that I forwarded to him the same views on the preceding *Monday*. Mr. Sylvester's own discussion of the problem is abundantly satisfactory; and I offer the above only because of its remarkable simplicity. Mr. Sylvester informs me that views similar to mine were presented in Paris, by M. Chasles, a few weeks ago.

I am, Sir, yours, &c.,

J. R. Young.

April 29, 1851.

THE ROTATION OF THE EARTH.

[Having republished last week, from the *Times*, a letter by "B. A. C." calling in question the "Reality" of the phenomenon observed by M. Foucault, it is but fair we should extract from the same journal the following satisfactory and most interesting reply from the pen of Mr. Sylvester.—Ed. M. M.]

Sir,—There is no force in the objections of "B. A. C." to the conclusions of M. Foucault, which rests upon the most incontrovertible grounds of strict mathematical deduction.

Having with some difficulty succeeded in discovering my way to "B. A. C.'s" meaning as contained in the third and fourth paragraphs of his letter, I find that his argument, or what is proposed as such, when stripped of all irrelevant matter, amounts to this—that provided a pendulum set agoing in the meridian line at any point of the earth's surface may be assumed to move precisely as it would do if the earth were at rest, save only that credit be taken at each point of its path for the difference between its horizontal velocity towards the east, due to the earth's rotation, and the correspondent velocity due to the same cause of each point in the earth's surface over which the pendulum passes, then, and in such case the plane of vibration would undergo no permanent displacement. As this hypothesis, which discards all the mechanical conditions of the question, is purely gratuitous, it is unnecessary to discuss the correctness of any conclusions supposed to be founded upon it. I should have thought that a writer conversant with the names at least of the instruments of mathematical investigation would have shrunk from the palpable absurdity of asserting in contravention of that article of faith of every reasoning mind which teaches that from continuous causes continuous effects must flow, and would have suspected some error in the premises which could have conducted to so monstrous a proposition as that the rate of displacement to be estimated could be finite and appreciable for two points on the earth's surface, and "nothing, or excessively minute," for all points between. Before any mathematical tribunal in the world such a plea upon the record would be laughed out of court, and the plaintiff nonsuited, without the defendant being put to the trouble of making any case in disproof of the allegations offered in its support.

M. Binet's investigation of the question in the *Comptes Rendus* for the 17th of February, 1851, leaves nothing to be desired in point of rigour of demonstration, so far

as quantities of the first order of smallness are concerned.

The same result has been obtained after a more compendious method by two English analysts, whose names I am not at liberty to mention, the work one of whom lies before me, and the correctness of which I can attest. In fact, the problem presents no particular difficulties so far as relates to obtaining the equations of motion, and their approximate solution, which is quite sufficient for most practical purposes. To what extent the small terms, neglected in the first approximation, might in the course of time affect the character of the phenomenon remains to be, and is in the course of being, worked out.

For the satisfaction of that numerous and respectable body of thinkers who form an intermediate class between those who are incapable of any proof except what appears directly to the senses, and the elevated few who can comprehend the force of an analytical investigation, I offer a brief and rapid recapitulation of the argument rather hinted at than expressed in my previous letter.

At the pole it is obvious that the plane of vibration (abstraction made of the earth's annual movement) remains fixed in space, and therefore appears to revolve with and for the same reason as the sun, at the rate of 15° per hour, so as to tend to complete one revolution in four-and-twenty hours. At the equator "the law of sufficient reason" shows immediately that there can be no permanent rotation either way. For, suppose the pendulum to be set moving in any direction across the equinoctial line, at the beginning and end of the first semi-oscillation it will be on different sides of the equator, and considerations of symmetry show that, whatever cause should be supposed to exist for making the north end of the plane of vibration turn round as the sun turns round when it is north of the equator, an equal cause would operate to make the south end of the same plane turn round as the sun turns round when it is south of the equator. But clearly these two equal motions ascribed to the plane are inconsistent with or would neutralize one another, just as a turnstile capable of going round both ways, which two people on opposite sides of the pivot should be pressing against with equal strength, would admit passage to neither of them. Be it well observed that this reasoning applies to experiments supposed to be made at the equator, and at no other point of the earth's surface. As regards places intermediate between the pole and the equator, a rough, but substantially correct view of the phenomenon to be expected may be reasoned out thus;—

It is well known to geometers that a rotation of a rigid body about one axis may be ideally separated into two smaller rotations about any two axes at right angles to one another lying in a plane passing through the first; the rotation of the earth about its pole may accordingly be supposed to be replaced by two simultaneous rotations about two ideal poles, one running straight up under the place of observation, the other passing through the earth's centre at right angles to the former. This latter pole, in respect to which the place of observation is, as it were, situated at an equilateral line, will produce no immediate effect. The principal, and I may say total, observed effect will be due solely to the rotation about the ideal pole, which is on a line with the point of suspension, and the rate of the rotation of the plane of vibration will correspond to the rate of rotation about this pole, which may be shown by geometry to be the entire and true rate diminished in proportion of the sine of the latitude to unity, or, which is the same thing, in the proportion of the perpendicular distance of the place of observation from the equator to the radius of the earth.

Irrespective of all geometry and arithmetic, it is clear to common sense that if the motion be 15° per hour at each pole, and zero at the equator, it will be some quantity gradually tapering off from 15° to nothing —that is to say, the time required for a complete revolution will go on increasing from twenty-four hours to an eternity, as we pass up and down from the poles to the equator.

But I have found many persons exceedingly perplexed to follow in their mind this relative motion at intermediate points, and who think it a hard tax upon their faith to believe that when the earth has gone once fairly round the *status quo* as between the horizon and the plane of vibration should not be restored. Some, accordingly, are driven to suppose that the motion is 15° per hour everywhere except at the equator; others, like your correspondent, that it is 15° nowhere except at the pole. The truth is, that such persons are striving to put a greater load upon common sense, or what should be termed immediate intuition, than it will well bear. The motion is the result of a rational and mathematical investigation, and extra to the pole cannot well be followed by the mere conceptive faculty; in fact, except at the pole, where the plane of vibration is fixed, and the earth passes under it, two things have to be considered—not merely the motion of the earth, but that of the plane of vibration itself (if this mode of explanation be attempted to be kept up), and it will be the difference of these two motions which

becomes apparent to observation. Nothing, however, is gained by this mode of looking at the question, and the public should not be so unreasonable as to expect that every conclusion of calculation admits of being made clear to popular apprehension.

The experiments connected with the practical demonstration of the phenomenon require to be conducted with great care; and some discredit has been brought upon the attempts to illustrate it in this country by persons who have not taken the necessary precautions to protect the motion from the eccentric deviation to which it is liable, and which may, and indeed must, have the effect of causing, in some cases, an apparent failure, and in others a still more distressing, because fallacious, success. I believe, from the character of the persons connected with the experiments, that the true phenomenon has been accurately produced and observed in Paris. I doubt whether as much can be said, with entire confidence, of any of the experiments hitherto performed here at home.

Any want of symmetry in the arrangements for the suspension of the wire, or in the centring of the weight, exposure to currents of air, or the tremulous motion occasioned by the passage of vehicles, may operate to cause a phenomenon to be brought about curious enough in itself, as a result of mathematical laws, but quite different from that supposed. The phenomenon of the progression of the apsides of an oval orbit here alluded to is familiar to all students in mechanics.

It is perfectly absurd for persons unacquainted with mechanical and geometrical science to presume to make the experiment. Indeed, such efforts deserve rather the name of conjuring than of experiment; but in this, as in many other matters of life, it is true that "fools rush in where angels fear to tread." Perhaps the too-hasty rush at the experimental verification of Foucault's law may account for some persons in England, whose opinions when given with due deliberation are entitled to respect, having allowed themselves to express doubts (which I understand, however, have been since retracted), as to the truth of the law itself. In Paris, there was no difference of opinion among such men as Lamé, Poinsol, Binet, Leonville, Sturm, Chasles, Bruvues, I believe, Arago, Hermite, and many others with whom I conversed on the subject, except as to the best mode of making the theory popularly intelligible.

So long ago as 1742-3 the Marquis Poleni (a Venetian by birth), in a paper in the "Philosophical Transactions," gave what upon a cursory inspection appears to me to be a statement, in sufficiently crabbed Latin, of the fact of the motion of the plane of vibration, which, however, he qualifies as "*Hercle, pertenuis et exilis*," (I quote from memory). It was Foucault's great merit to have overcome what still remains the stumbling-block to those to whom the subject is presented for the first time; viz., the difficulty of seeing that the motion of the plane would be, not alternating, but accumulative in one direction.

I am, Sir, your obedient servant,

J. J. SYLVESTER.

Lincoln's-inn Fields, April 25.

THE GREAT EXHIBITION OF 1851.

On May day this "Exhibition of the Industry of All Nations" was opened with prodigious pomp and magnificence; the Queen presiding at the ceremony—the heads of all the public departments assisting — the Church bestowing its blessing—the people cheering, bells ringing, organs pealing, trumpets twanging—all else forgotten for the moment, in a universal ecstasy of admiration and delight.

To speak of this affair in the light in which it first presents itself to our notice, as a popular show or spectacle, it may be freely allowed to surpass in grandeur and beauty every thing of the kind ever before seen or heard of; and so far therefore it fully justifies the strong hold which it has taken on the sympathies of the public.

The more serious aspect in which its promoters desire it should be regarded is, that of a trial of industrial skill between the nations of the earth—a sort of revival of the ancient Olympic Games; but that, we apprehend, is hardly the character in which it is destined to take its place in history. For suppose it be granted, that there has been a fair challenge thrown out to all nations to do their best on the occasion; a challenge to count for any thing must be accepted. Now this is a challenge of such a nature that it is *impossible* to fix any people with the acceptance of it. The exhibitors of any particular nation may be numerous, but there are no means existent of determining whether that number forms the majority of the persons of artistical "mark" in that

nation, or is made up—as it may possibly enough be—of its botchers and bunglers. A very small minority of non-exhibitors may include a country's best hands, and therefore utterly discredit the claims of the majority to represent its talents and capabilities. Take our own country, for example—the British part of the Exhibition is so extremely respectable, that we might be well content to stake the manufacturing reputation of Britain upon it; but missing, as we do, many a distinguished name in almost every department, how can we presume to say that this really shows what British industry and ingenuity are capable of? Besides, they are not all English, or French, or German, &c., who call themselves so; nor is the mere labelling of a stall or groupe of stalls with the name of this or that country any sure proof that it contains only that country's wares. We observe instances not a few of Englishmen exhibiting as Frenchmen, and Frenchmen as Englishmen: some of persons exhibiting both as Englishmen and Frenchmen; and many more of masters, both native and foreign, exhibiting the productions of alien workmen as specimens of the handiwork of their own countrymen. To attempt, therefore, to construct any comparative scale of the state of the arts in different countries, from the displays here made under their respective national flags, would be most unsafe, and might, possibly, be exceedingly delusive.

The utmost that can with truth be conceded, is that it is an exhibition of works of industry by individuals of all nations, but not by the nations themselves, *as nations*.

Of the good, either national or cosmopolitan, which the Exhibition is likely to do, we entertain, as our readers are aware, a very indifferent opinion; but having, on former occasions, fully stated our views on this head, we shall not now seek to re-urge them.

The nations which show to most advantage—assuming for the nonce that each flag waves only over its own country's products—are, first of all, England, with her foreign possessions (amongst which India stands honourably conspicuous); next France; then Belgium, Prussia, and Austria. The United States' portion of the Exhibition is most unexpectedly meagre and common-place.

We propose, in a series of weekly papers to be commenced next week, to select for description such articles as are most remarkable for novelty or merit; and trust to be able to do all that truth requires at our hands in this respect, before the Exhibition is closed.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 1, 1851.

JOHN ROBERT JOHNSON, of Crawford-street, chemist. *For improvements in fixing colours on fabrics made of cotton or other fibre.* Patent dated October 17, 1850.

1. The first portion of this invention consists of a method of isolating or extracting the colouring matter from madder or other rubiaceous plants, such as munjeet, &c., so as to render it fit for application directly to the fabric, instead of by the usual method of dyeing. The madder must be first converted into garancine, and then washed until all traces of acid employed in the operation are removed. It is then dissolved in a hot aqueous solution, which possesses the property of taking up the colour while hot and surrendering it when cold. When this solution has cooled, the colour will be found in deep orange flakes, which are to be separated by filtration, and washed till free from acid; and tasteless. Several alkaline and earthy substances in combination with free sulphuric and muriatic acids possess the above property, —amongst others, the chloride of calcium and muriatic acid may be mentioned; but the patentee prefers potash or ammonia-alum and sulphuric acid, and composes his solution of 10 lbs. alum, 1¼ lb. sulphuric acid, and 10 gallons water. The simple abstraction and addition of heat is all that is requisite to admit of the same solution being repeatedly used; and in order to economize time and fuel, it is recommended to run the used liquor of one solution through a worm, immersed in the vessel containing the hot solution of another operation, by which the latter will part with a portion of its heat, and assist materially in raising to the desired temperature the solution about to be employed.

The solvent influence of alum on alizarine (the colouring matter of madder), has been

long known, and acid has been also employed to precipitate the colouring matter held in suspension in such solution. The patentee disclaims therefore the alternate use of solutions of alum and acid, but claims the application of a solution of alum with excess of acid or other acidified saline solution, capable by the abstraction and addition of heat, of being rendered again and again fit for use for extracting the colouring matter from madder and other rubiaceous plants. Also abstracting the heat from one solution to the other, or *vice versâ*, as described in the extraction of the colouring matter from the rubiaceæ, in order to its being applied directly to fabrics of cotton, silk, &c.

The colour may be fixed on the cloth by the use of an aluminous mordant,—as in Fauquet's method, &c.; but the patentee prefers the process to be next described.

2. In this method the colouring matter is applied simultaneously with a mordant, and fixed by steam. When printed in this manner on unprepared cotton, the colour yields to soap, but it may be rendered stable by preparing the cloth with an oleaginous mixture; the fine hue of the madder is not however fully developed, except the oil is previously oxidized, as in the Turkey red process. The preparatory mixture employed consists of 5 lbs. white soap, 5 lbs. gallipoli oil, and 10 gallons water. The cloth is padded in the mucilage, dried, "aged" for forty-eight hours in a warm room, rinsed in a solution containing 1 lb. of carbonate of soda to twenty gallons of water, and dried, when it is ready for the printing operation. A somewhat similar effect will be produced by a strong solution of soap. Any salt of alumina may be employed as a mordant, but the acetate is recommended. For printing, the patentee makes a mixture of ten parts of madder extract in paste, containing 10 per cent. of dry extract, with one part of pure acetate of alumina, of the strength of 25° Twaddel and gum tragacanth to thicken. After the application, the cloth is to be hung up for a few hours, than steamed for half an hour at as low a pressure as possible, rinsed in an aqueous solution containing $\frac{1}{1000}$th part by weight of an alkaline carbonate or phosphate, washed and dried. The colour will bear "raising" with weak caustic alkali, or lime, and will be improved by being "soaped," after "raising" and washed. The quantity of aluminous salt may be increased without a corresponding alteration in the colour produced; but when the proportion exceeds 25 per cent. of a strength of 25° Twaddel, the colour ceases to be fixed, even on oleaginous cloth, and resembles ordinary printed madder lake. By the substitution of a salt of iron, the red colour of the madder may be modified towards a chocolate or black.

The claim under this part of the invention is for the use of oleaginous matter, in order to fix the colouring matter of madder when applied topically; that is, by direct application to the cloth or fabric.

3. When dyeing with madder, according to the methods ordinarily in use for the purpose, the articles have to be subjected to several operations of soaping and branning, to brighten the colours and clear the whites; and in order to enable the colour to resist these operations, a very large quantity of it is required to be used (while sometimes the madder is converted into garancine, when the whites will be clear and pure). Now, the patentee has discovered that an equally valuable effect is produced—1, by reducing the quantity of colouring matter 25 per cent. below that absolutely required where the clearing processes are employed; and, 2, by padding into the dyed piece some bleaching agent, and then drying it over the flue of the padding machine, or the tins of the dressing machine. The ordinary "clearing powder" (chloride of lime) is suitable for the purpose, but hypochlorite of soda is recommended, and may be obtained for the purpose by adding to a solution of chloride of lime a solution of soda crystals (carbonate of soda), until the lime ceases to be precipitated. Fifteen parts of this solution, at a strength of 10° Twaddel and eighty-five parts of water, constitute a mixture adapted for padding into the cloth.

The operation of dyeing is performed in the usual manner, but with the reduced quantity above mentioned; the patentee, however, prefers to treat the madder for four or five hours with water heated to 120° or 125° Fahr. The soluble yellow colouring matter will be then converted into a red colour (alizarine), and pectic fermentation will commence, and the mass, when fermented, will be found to contain pectic or pectosic acid. The colouring matter is employed in the fermented state to economize time, labour, and fuel.

The claim here is for the application of the processes described, to the production of colours and clear whites, without the use of soap, bran, or garancine. Also, for the employment of fermented madder to economize time, fuel, and labour.

4. This portion of the invention relates to a method of obtaining clear whites and bright colours from spent madder without previous heating by steam or otherwise—*i. e.*, without converting the madder into garancine. The madder is to be treated with dilute muriatic acid (according to

Steiner's process, patented June, 1832) till all the salts of lime are removed, when it is introduced into the dye vessel with enough of an alkaline carbonate to impart a reddish tinge. The colour is taken up by the mordants, but the whites are bad, and this renders Steiner's process of comparatively little value. By adopting the above-described method of procedure, the whites are rendered pure and clear.

The patentee claims the application of the clearing process, to obtain colours and pure whites from spent madder without the necessity of converting it to garancine.

5. Mr. Johnson describes finally a mode of obtaining a topical colour from the alkanet root (*anchusa tinctoria*) by digesting it in oil of turpentine, naphtha, or other cheap essential oil, and adding one-eighth of its volume of caustic baryta, or of a salt of baryta and caustic ammonia. The colouring matter will be seized on by the earth and separated from the essential oil, leaving it fit for another operation. The deep indigo blue mass of colour and earth is then to be neutralized with acetic acid, and when printed on aluminous cloth will produce a fine purple colour. Or the acetic mixture may have a mordant added to it in the usual way of printing with topical colours, and applied on oleaginous cloth prepared as before described, when a rich purple will be produced resisting soap and alkali.

Mr. Johnson claims under this head of his invention the application of anchusine, the colouring matter of alkanet, as a topical colour, and the above-described process of extracting it.

EDWARD CLARENCE SHEPARD, of Parliament-street, Westminster, gentleman. *For certain improvements in electro-magnetic apparatus suitable for the production of motive power of heat and light.* (Communicated by Floris Nollet, of Brussels.) Patent dated October 24, 1851.

Claims.—1. An arrangement of four compound magnets in a peculiar manner represented and described.

2. A like peculiar combination of four pairs of helices with armatures and other appliances.

3. A system of parallel multiplying spirals united in cylinders of indeterminate length, and producing powerful and active induced currents by their combination.

4. An oscillating arrangement of helices.

5. A rolling arrangement of helices.

6. The employment of flat helices as substitutes for the wires in a system of flat spirals.

7. Certain magneto-electric current condensers.

8. The application of dry piles, and of secondary piles, for the purpose of increasing the intensity both of direct and of the induced currents.

9. An electro-chemical motive power as represented, but only as regards the cylinder thereof and its appendages.

10. An apparatus for lighting by the incandescence of prepared charcoal.

11. Lighting by hydrogen gas saturated with vapour of any hydro-carburet, and burning in ordinary gas burners.

THOMAS BEALE BROWNE, of Hampen, near Andoversford, gentleman. *For improvements in weaving and preparing fibrous material, and staining or printing fabrics.* (A communication.) Patent dated October 24, 1850.

Claims.—1. Weaving wide fabrics in looms of less width than those fabrics woven by employing two or more sets of warps ranged one above the other in the same reed, and tying the edges of the separate warps, so as to produce two perfect selvages.

2. The application of a toggle joint or jointed bar, in combination with the crank and connecting-rod, to produce a double beat-up in looms.

3. An arrangement of apparatus for rubbing or crushing, scutching and heckling, flax, hemp, and other fibrous materials continuously in the same machine, and especially in such machinery, the employment of two pairs of vertical rollers with a vibratory motion, of rotary scutchers with serrated edges, and of a peculiar construction of heckle pin.

4. In machinery for staining or printing fabrics—the employment of travelling beds so arranged that the blocks or forms move on rails around a circle in a straight line during the printing operation. Also an arrangement for feeding in the material to the machine.

JOHN MERCER, of Oakenshaw, within Clayton-le-Moors, gentleman. *For improvements in the preparation of cotton and other fabrics and fibrous materials.* Patent dated October 24, 1850.

This invention consists in subjecting vegetable fabrics and fibrous materials, cotton, silk, and other fibres in the raw or manufactured state to the action of caustic soda or caustic potash, dilute sulphuric acid, and chloride of zinc, of a strength and temperature calculated to produce the results afterwards pointed out.

1. In applying this invention to the treatment of bleached cloth composed of cotton and other vegetable fibre, the cloth is passed through a padding machine charged with caustic soda or caustic potash of a strength of 60° to 70° Twaddel, and at the common

temperature (about 60° Fahr., or under); it is then washed without being dried, and immersed in dilute sulphuric acid, and again washed. Or it is run over and under rollers in a cistern, with caustic soda or caustic potash of 40° to 50° Twaddel (at common temperatures); the last two of which are set so as to squeeze any excess of alkali back into the cistern. It is then passed over and under rollers in a series of cisterns filled with water, so that at the last cistern the cloth will be almost entirely free from alkali. After passing the cloth through the padding machine, or the cisterns above described, it is washed, soured with dilute sulphuric acid, and washed again, when it will be fit for use.

The same process, slightly varied, is also applied to the treatment of gray or unbleached cloth, of warps, of hanks of thread or yarn, and of the fibre previous to its manufacture.

The cloth, when thus treated, will be found to have shrunk, both in length and breadth, and to have become thicker; the effect produced being similar to that of the operation of fulling on woollen fabrics. It will have become stronger, each thread requiring greater force to break it. It will have acquired considerably increased capability of receiving and retaining colours; and it will be found to be much heavier, as may be proved by weighing it at the same temperature before and after the operation.

2. The patentee employs sulphuric acid diluted to about 105° Twaddel; and in this case the operation is performed in exactly the same manner as if caustic soda or potash were employed, with the exception of the last souring process, which will be rendered unnecessary.

3. Chloride of zinc may be employed. This is used of a strength of 120° or 125°, and a temperature of about 160° Fahr.

In operating on fabrics composed of mixed vegetable and animal materials, it is preferred to use the alkaline solution of a strength of 30° or 40° Twaddel, and at a low temperature to prevent injury to the latter.

Claim.—The subjection of cotton, linen, or other vegetable fibrous material, either in the fibre or any stage of its manufacture, and either alone or mixed with silk, woollen, or other animal fibrous material, to the action of caustic potash or caustic soda, dilute sulphuric acid, or solution of chloride of zinc, of a strength and temperature sufficient to produce the new effects, and give them the new properties above described, either by padding, printing, or steeping, immersion, or any other method of application.

SAMUEL JACOBS, of Highgate, Kendal, cabinet-maker. *For certain improvements in printing on woollen, cotton, paper, and other substances, parts of which improvements are applicable also to the purposes of colouring, shading, tinting, or varnishing such substances.* Patent dated October 24, 1850.

Claims.—1. An improved construction of colour-trough or server.

2. The application of this server to cross-shading, tinting, &c.

3. The application of this server and apparatus in connection therewith to hand-block printing machinery.

4. An improvement in veneering wood, in staining wood, in colour-shuttles, in colour-grinding mills, and in certain apparatus employed in connection therewith.

ALEXANDER DIXON, of Abercorn Foundry, Paisley. *For improvements in moulding iron and other metals.* Patent dated October 24, 1850.

These improvements have relation to a method of forming moulds of green or dry sand for casting cylinder pipes, &c., of iron and other metals. The core bar is first placed in its position inside the mould-box; the intermediate space is then filled with sand, and a metal mould, of a similar shape to the casting to be produced, inserted by a machine consisting of a sliding rack and pinion. The mould is then withdrawn, and the mould-box and finished mould removed to receive the black-wash previous to casting. The fillet of the pipe is moulded separately, and secured to the top of the mould.

Claims.—The means of making the moulds and cores of pipes, cylinders, fluted columns, square tubes, and other castings of a similar nature, as described.

JOHN OLIVER YORK, of Boulogne-sur-Mer. *For improvements in the mode or manner of generating steam in locomotive, marine, and other boilers.* Patent dated October 24, 1850.

The improvements here claimed comprehend,

1. A method of generating steam by the employment of gas alone. The gas-burners are arranged in flues in the interior of the boiler, thus economising space, and rendering the boiler as compact as possible.

2. A method of generating steam by the combined application of gas, and coal or coke, to the same boiler at the same time. The boiler here employed is cylindrical, and has a furnace with a flue at one end for burning coal or coke, and a second flue encircling the first, which is provided for the gas-burners. These latter are applied to the exterior under surface of the boiler, and are inclosed with a suitable casing. The gas is to be supplied at the ordinary pressure, and the apertures in the burners to be of a size adapted to the supply of gas.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Daniel Dalton, of Span-lane, West Bromwich, Stafford, for improvements applicable to railroads. April 26; six months.

J. C. Haddan, of Bloomsbury-square, civil engineer, for improvements in the permanent way of railways, in railway and other carriages, and in the manufacture of papier maché to be used in making carriages and other articles. April 26; six months.

James Bagster Lyall, of Thurlow-square, Brompton, Middlesex, gent., for an improved construction of public carriage. April 26; six months.

Benjamin Hyam, of Manchester, tailor and clothier, for certain improvements in the method of fastening down trousers, or other articles of wearing-apparel. April 26: six months.

Jonathan Wragg, of Wednesbury, Stafford, coach and axle-tree smith, for certain improvements in railway and other carriages. April 26; six months.

Robert Milligan, of Harden Mills, near Bingley, York, manufacturer, for a new mode of ornamenting certain cloth fabrics. April 26; six months.

James Nasmyth, of Patricroft, Lancaster, engineer, and Herbert Minton, of Stoke-upon-Trent, Stafford, China manufacturer, for certain improvements in machinery or apparatus to be employed in the manufacture of tiles, bricks, and other articles from disintegrated or pulverized clay. April 26; six months.

Benjamin William Goode, of Birmingham, Richard Boland, of the same place, and James Newman, also of Birmingham, for improvements in chains, chain-pins, swivels, brooches, and other fastenings for wearing-apparel. April 29; six months.

Henry Lund, of the Temple, esq., for improvements in propelling. April 29; six months.

Philip Webley, of Birmingham, manufacturer, for improvements in the manufacture of boots and shoes, and in rendering the said manufacture waterproof, also in the machinery and materials to be used therein. April 29; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
April 24	2790	J. Hughes	Queen-street, Radcliff	Liquid ships' compass.
,,	2791	J. Jackson	Bradford	Flyer.
25	2792	Grigg and Jenkinson	Bunhill-row	Fastening for metallic bedsteads.
,,	2793	H. Robinson	Castle Warden, Naas	Roofing tile.
26	2794	Ainge and Aldred	126, Oxford-street	The Camden archery tablet.
,,	2795	J. Meller	Manchester	Apparatus for indicating the height of water in boilers and the pressure of steam.
28	2796	C. F. O'Toole	Nottingham	Military vest.
,,	2797	H. M. Page	Coventry-street	Dressing glass.
29	2798	C. Rowley	Addle-street	Instructive card for carding dress fastenings.
,,	2799	T. J. Baker	Famdon	Double power beam pump.
,,	2800	J. Wright	Chipping Ongar, Essex	Refrigerator.
,,	2801	J. J Greenin	Brighton	Ladies' railway case.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

24	181	C. Farrow	Great Tower-street	Self-closing valve.
25	182	J. G. Shipley	Regent-street	Stirrup leather.
,,	183	T. W. Stapleton	King-street	Coffee urn.
28	184	B. Clarke	Chelsea	Potato-drying steamer.
,,	185	M. Rabiot	Finsbury	Invalid seat, or couch.
,,	186	J. Hancock	3, Conduit-street	Curved instep boot.
,,	187	J. Smith	Hornsey	Strawberry pan.
,,	188	J. Smith	Hornsey	Hyacinth supporter.

CONTENTS OF THIS NUMBER.

Grant's Patent Steam Boiler.—Specification—(*with engravings*) 341

Design for an Industrial School. By "M. S. B." 343

On the Received Methods of Calculating the Displacement in Naval Architecture. By Joseph Woolley, LL.D., of the Naval College, Portsmouth 347

The Screw Propeller. By Lieut. W. Gordon, R.N. 349

Millington's Patent Corn and Flour-cleansers.—Specification—(*with engravings*) 350

Rotation of the Earth:—

Reply to "B. A. C.'s" Doubts of the Reality of the Phenomenon. By J. J. Sylvester, Esq. 353

Explanation of the Phenomenon. By Professor Young 352

The Great Exhibition of 1851—The Opening ... 355

Specifications of English Patents Enrolled during the Week:

Johnson ..... Cloth-printing 356

Shepard ..... Motive-power Heat 358

Browne ..... Calico-printing 358

Mercer ..... Preparation of Cotton, &c. 355

Jacobs ..... Colouring, Shading, &c. 359

Dixon ..... Moulding 359

York ..... Generating Steam 359

Weekly List of New English Patents 360

Weekly List of Designs for Articles of Utility Registered 360

Weekly List of Provisional Registrations 360

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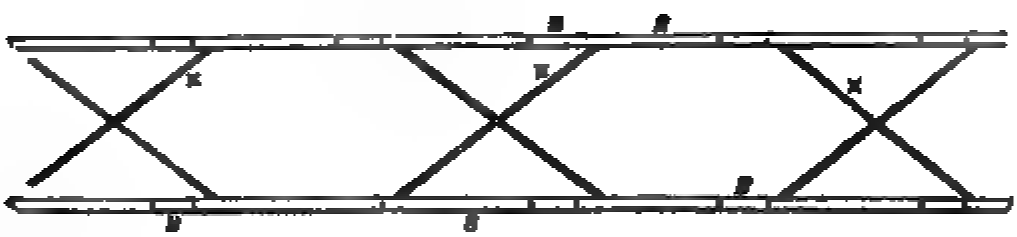
SHEPARD'S PATENT ELECTRO-MAGNETIC AND HEAT, LIGHT, AND MOTIVE-POWER MACHINES.

Fig. 1.

Fig. 5.



SHEPARD'S PATENT ELECTRO-MAGNETIC HEAT, LIGHT, AND MOTIVE-POWER-PRODUCING MACHINES.

(Patent dated 24th October, 1851. Patentee, Edward Clarence Shepard, of Parliament-street, on behalf of Floris Nollett, of Brussels. Specification enrolled 24th April, 1851.)

Specification.

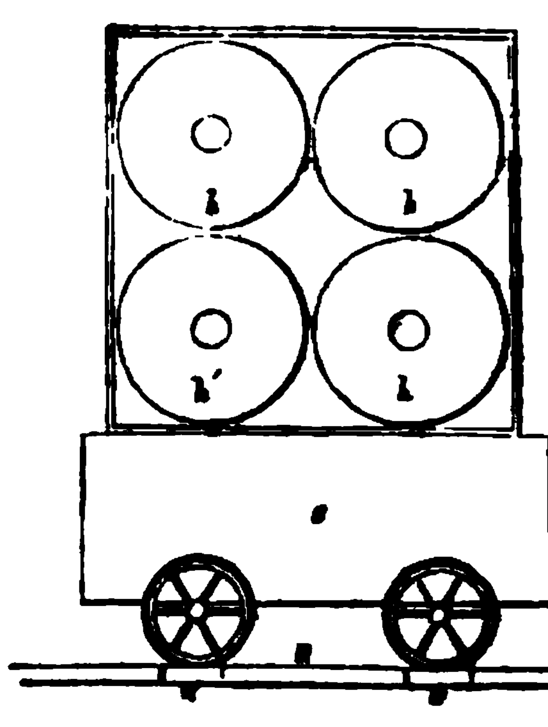
Figure 1, A B and A¹ B¹ are parts of four compound magnets, each composed of from seven to nine bars of very hard tempered cast steel, not less than 84 centimetres (33 inches) in length, 5 centimetres (2 inches) in breadth, 8 centimetres ($3\frac{1}{4}$ inches) in thickness, magnetised by means of electro-magnetism. Each bar is bent into two parallel legs about 4 to 5 centimetres (1 and $\frac{3}{5}$ths to 2 inches) apart. These four magnets are arranged in two pairs by means of plates of wood or brass, and brass adjusting screws *e e*, the magnets being kept at the same distance apart as the bars of which each magnet is composed.

The two pairs of magnets are fixed horizontally on the base of the frame of the apparatus, so that their opposite poles A B, A¹ B¹ face one another, and at such a distance that the ends of four helices pass, during their rotation, immediately over and between the poles of these magnets, and as near to them as may be without touching.

The positions of the magnets A¹ and B¹ are indicated by dotted lines. C C C¹ C¹ are the four helices forming part of a set of eight, connected by the armatures D D and D¹ D¹ (fig. 2), which cross one another, being furnished with an insulating substance interposed between them at the point of intersection. The helices are united in pairs by being mounted upon a wooden spindle; the whole are joined together by the armatures D D and the axle *a*. These helices are formed of two wires of very fine copper, about 1 millimetre ($\frac{1}{25}$ of an inch) in diameter, covered with some insulating substance, as silk, cotton, varnish, or, what is still better, a thin layer of gutta percha, through which the wire has been drawn while both wire and gutta percha are at a temperature nearly that of boiling water (100° Centigrade). These two wires are wound in the ordinary manner round a hollow soft iron axis, about 5 to 6 centimetres long (2 to $2\frac{3}{8}$ inches), and about 4 centimetres ($1\frac{5}{8}$ inches) in diameter. The length of each of these wires should at least be about 150 metres (170 yards). The hollow cylindrical centres or discs of the helices terminate in two plates about 3 centimetres ($1\frac{1}{4}$ inches) in width, bent back against the discs or ends of the helices, and the extremities of the plates are bent up at right angles to a height of from 5 to 6 millimetres ($\frac{3}{16}$ths of an inch), and kept sufficiently apart to allow of the poles of the magnets passing freely without touching during their rotation.

The horizontal axis *a* is centred upon two steel pivots, and passes through the middle of the armatures, where it is firmly secured. This axis carries two pairs of ivory discs or pulleys E E E¹ E¹, into which are inserted four segments of copper cemented by means of gutta percha, and separated by slips of ivory of about 1 millimetre ($\frac{1}{25}$ of an inch) in thickness, which last are kept a little in relief to prevent the copper segments from ever touching two of these slips at once. The metallic segments communicate by means of arms arranged in the form of a cross, the direction of the diagonal of one disc corresponding to the diagonal of the other of the same pair, whereby all the currents are made to flow in one direction.

Fig. 4.



F is a pulley about 3 centimetres ($1\frac{1}{4}$ in.) in diameter, over which is carried a gutta percha band, which passes over a second pulley of about 1·5 metres (57 inches) in diameter, placed immediately above the other, which arrangement allows of a rotary speed of from 50 to 100 revolutions per minute being obtained with, at the utmost, not more than half a man's power. By these means two pairs of primitive currents, constant in one direction, and of an intensity capable of producing various physical phenomena, such as of heating to redness and melting metallic wires, and rendering large cones of carbon incandescent, causing rapid chemical decomposition, &c.; but instead of making them thus act on the poles of the wires which terminate this arrangement of primitive current helices,

they are made to communicate and pass into one or other of two supplementary systems namely, the system of spirals, or the system of current condensers.

Another arrangement of the system of helices which I have found to succeed well, consists in fixing the whole of the eight helices at the end of a pendulum of about 1 metre (39 inches) in length, mounted in a frame, as represented in fig. 3, having a vertical oscillatory movement between the poles of the magnets, which are arranged horizontally; a similar arrangement being adopted at the other end of the lever. Eight pairs of helices *h*, *h*, *h'*, *h'*, may be thus set to work at the same time, and this number may be doubled, trebled, or even increased at pleasure (within a certain limit) by prolonging the arms of the lever to a sufficient extent, for which purpose the levers may, if necessary, be composed of several parts articulated or jointed together. The movement of the pendulum is communicated, and the range of the oscillations regulated by means of an eccentric L, the lower end of the rod M of which, is jointed to one of the arms B of the pendulum, or lever N, at a convenient distance from the fulcrum O. This eccentric is fixed on a shaft placed perpendicularly over the lever, and put in motion by two pulleys PP', and band R; the small pulley P is placed on the shaft of the eccentric, and the large pulley P' is about twenty to twenty-five times the diameter of the smaller one, and is put in motion by means of a handle S.

Fig. 2.

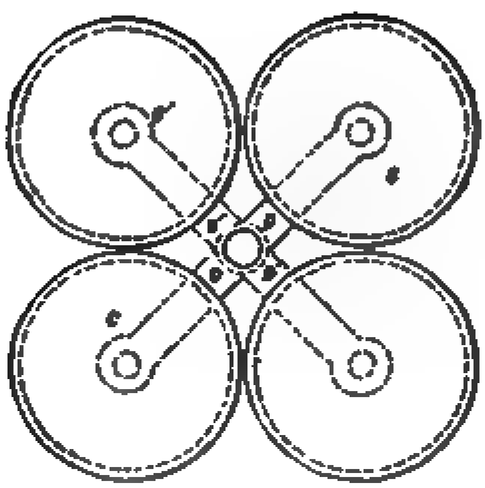


Fig. 6.

In another which may be called, *The Rolling System* (see figs. 4 and 5), the magnetic bars are kept in their horizontal position; but the helices *h h*, *h' h'*, are carried on a little carriage C, which runs on rails R R, and passes alternately in front of the poles of the magnets by means of a to-and-fro movement, derived from two eccentrics keyed on one common axis, side by side, but diametrically opposed in their eccentricities, in order that there may be an equilibrium of action on both sides of that axis, each eccentric moving the same number of pairs of helices; for the eccentrics cam-wheels may be substituted, or any other equivalent mechanical means. By this sort of movement little force is expended, and at the same time there is little risk of derangement of the parts. The different parts of the rails R R are insulated from each other by ivory plates B B. C is one of the cur-

riages by which the helices are made to travel in front of the magnets. Any desired number of these little magneto-electric wagons may be placed on the same rails, and may be put in motion by the same mechanism. The ivory plates B B serve to break the flow of the currents, and the cross-bars X X unite them again, so that they may all flow in one direction.

The *motive power engine*, most proper for the purpose of this invention, is one of the form of an atmospheric steam engine without the boiler feeding-pumps and condensers. The dimensions of this motive power engine ought to be proportionate to the force desired to be obtained. But the bottom of the cylinder (see fig. 6) should be provided with a valve V, opening from the inside to the outside, whereby any slight excess of steam will pass away with the water of condensation, and produce the effect of reaction at the moment of the combination of the oxygen and hydrogen gases, in order to reconstitute the water in the state of steam. This valve is held up by the helical spring *h*. Just above the bottom of the cylinder is a small tube T, with a neck, to which is screwed a stuffing-box S, in which is placed an insulating ring, through which passes a rod R, which forms the axis of a small toothed brass wheel W. The upper side of this box is perforated with an opening, also provided with a boss *r* of some insulating material, in which a metallic wire P is luted, which communicates with one of the polar wires of one of the pairs of helices of the electro-magnetic apparatus, the other polar wire N being attached to the end of the prolongation of the axis of the wheel, a little beyond its bearing G. This prolongation carries a pulley L, to which motion is imparted by means of a strap from another pulley of a greater radius, and which is not shown in the engraving. There is fixed on the same axis R a little toothed wheel *w*, which gears into another wheel fixed on the axis of the fly-wheel of the machine, and which is provided with teeth only on a very small portion of its circumference, so that in one entire revolution of the fly-wheel it may transmit its motion only during an exceedingly short interval to the wheel W, and just at the instant at which the piston has made about one-fourth of its stroke. Numerous electrical sparks are thus thrown out every time that the teeth of the little wheel W inclosed in the box slide over the flattened end of the conducting wire P, communicating, as aforesaid, with one of the polar wires. These sparks then ignite the gaseous mixture arising from the decomposition of water admitted into the cylinder through a distributing apparatus or slide box. The quantity of gas admitted into the cylinder should be equal to about one-fourth of its capacity; experiment having shown that under the pressure of the atmosphere the ignition of gases generated by the decomposition of water, causes them to dilate during explosion to four times their bulk. The piston will then be forcibly driven to the end of its stroke, when immediately the water resulting from the combination of the gases will become condensed on the cold sides of the cylinder, and a vacuum be formed beneath the piston; then the atmospheric pressure acting with its entire force on the upper side of the piston will cause it to descend rapidly, and these motions continued will produce the rotation of the engine. Thus, by keeping up the supply of gases, and successively exploding them, a continuous movement of the machinery connected with the piston may be obtained.

For Claims, see *ante* p. 358.

GREGORY'S "LETTERS ON ANIMAL MAGNETISM."*

The publication of this work is likely to be an important event in the history of science in this country. In explanation, however, of this remark, and in justice to the many other experimenters and authors on the same subject, we must state, at some length, our reasons for such an assertion. The main *facts* of animal magnetism, mesmerism, or by whatever name it may be called, have been known, though but to a very small number of men, in every part of the world from time immemorial. They have been known under various names, and applied to various purposes. The healing art in one nation, and the conjuring or magical ceremonies of another, often made use of these *facts*, though without system or science. Illustrations, more or less direct and clear, of the fundamental laws of animal magnetism, are to be found, as well in the pages of ancient writers as in the modern traveller's description of processes

* "Letters to a Candid Inquirer on Animal Magnetism." By William Gregory, M.D., F.R.S.E., Professor of Chemistry in the University of Edinburgh. Taylor, Walton, and Maberly. 1851.

in use amongst various savage tribes at the present day. The medical transactions of the numerous societies in Europe abound in "curious and strange" accounts of what we now recognize as mesmeric phenomena. Now, so long as such accounts and narratives were isolated, and scattered in old books or modern travels, they were read with great interest and treated with considerable respect. Even medical men were ready to admit that they *might* be indicative of some wonderful powers in nature as yet unknown, or at least unexplained. But when such accounts began to arrive, thick and fast, in our own days, and almost under their own eyes, the same men who formerly believed tha scarce and rare accounts of such things, *now* refused to do so any longer. They could credit the fact of Hippocrates curing a poor Greek patient by sundry mysterious processes, but will not hear a word of Dr. Elliotson, of Conduit-street, curing a poor cockney by similar means. In fact, the theory has become too common and vulgar to be admitted into the creed of a fashionable M.D. Now-a-days when a few great men amongst the doctors declare that anything connected with their art is "humbug" or "imposture," forthwith all their brethren, with scarcely the exception of one in a hundred, cry out the same thing in chorus. And, lastly, whatsoever is thus anathematized by the medicos, is "taboo-ed" to their patients, *i. e.*, to nine-tenths of the rest of the public.

England is the last country in the world to believe anything that it cannot *understand*. And, moreover, good John Bull has such a mortal dread of being "humbugged" or made a fool of, that he flatly refuses to credit any account which the family doctor or anybody else chooses to call "imposture" or nonsense. So John Bull shakes his head and looks knowing.

We have no doubt that, if some wag amongst the audience at the Polytechnic, who go to see the new proof of the earth's rotation, were to hint, with a grave face, to the bystanders that it is "all humbug"—"all a trick of the lecturer's, who, with the aid of his assistants, is secretly making the table turn round by machinery underneath"—we say, we have no doubt that the majority of the said bystanders would go home with strong suspicions that they had been "humbugged," and that the pendulum had nothing to do with it. But, luckily, the *doctors* have not interfered as yet with this department of science, and so John Bull feels himself at liberty to believe with a quiet conscience, and goes home hugely edified by this new piece of knowledge.

The English, as we have said, are the last people on earth to credit what they cannot comprehend. And so it has come to pass, that the strange phenomena of animal magnetism have been studied and accepted by almost every nation on the Continent long before we, in this kingdom, had heard more than the name of it. Until within the last ten or a dozen years, there were hardly a score of men in England who knew any more about it, except that a French Commission had reported unfavourably of Mesmer's theory in 1784. Few even knew that this Commission, though rejecting Mesmer's *theory* (which was, undoubtedly, premature and objectionable), did not *deny his facts*. Most people contented themselves, whenever mesmerism was named, with saying—"Oh! the French Commissioners exploded all that long ago!" It was also conveniently forgotten that one of the Commissioners (Jussieu) refused to sign the unfavourable Report of his brother-Commissioners, and published one of his own, admitting all the essential features of the mesmeric phenomena. We shall now quote briefly from a little work by Mr. Lang ("Mesmerism, its History, Phenomena, and Practice," p. 4, &c.):—"The blow struck by the French Commissioners did not entirely answer the expected purpose. The question still continued to excite a high degree of interest in that country, but the breaking out of the Revolution, and the wars which followed that event, turned the public attention in other directions. * * * Many men of the highest eminence on the Continent of Europe, despite the din of war

around them, devoted a considerable degree of attention to mesmerism; and in progress of time it began to be heard of in the works of the great German physiologists—Sprengel, Reil, Authenrieth, and others,—names as well known on the Continent as those of Harvey or Hunter in Britain. In 1817 the practice of mesmerism was by law ordered to be confined to the medical profession in the Prussian dominions; and in 1818 the Academy of Sciences at Berlin offered a prize of 3,340 francs for the best treatise on mesmerism. In Denmark, and even in Russia, about the same period, the subject was brought under investigation; and in the latter country, a Committee appointed by the emperor declared it to be "a most important agent." These things could not go on without challenging investigation in France, from whence the first Report of a Commission had emanated, and accordingly in the year 1826, a new commission of inquiry was appointed by the Royal Academy of Medicine, of Paris. Various obstructions were thrown in the path of the Commission, but at length, in 1831, the Report came forth, acknowledging to the full extent the truth of mesmerism; and adducing a vast body of evidence in its behalf. In Great Britain little was known of mesmerism down to this period. The unfavourable Report of the first French Commission was supposed to have settled the question, and the unhappy wars which ensued, deprived us to a great extent, during many years, of the means of intercourse with the Continent. In 1828 and 1829, the late Mr. R. Chenevix, a gentleman of large fortune, and a Fellow of the Royal Society, exhibited experiments to many of the most eminent scientific men in England; but he was scarcely listened to, and with the exception of Dr. Elliotson, no one seems to have cared for his labours * * In 1836, Mr. Colquhoun published his 'Isis Revelata,' in two volumes; a work which exhibits a large extent of learning and research, and the translation of the Report of the French Commissioners may be consulted in the Appendix to the second volume. The author was regarded by the bulk of men as an idle "dreamer, or at best, as a literary man amusing himself with a speculative subject; and little progress was made in opposition to the almost universal prejudice that was abroad." In 1837, Baron Dupotet came over and lectured on the subject in England, which called Dr. Elliotson's attention again to the subject: "The results were of the most successful description, many cases of a highly singular nature having been accomplished. *The jealousy, however, of the medical profession was roused, and it was resolved that mesmerism should, if possible, be put down.* In consequence of insults, to which it was impossible to submit, Dr. Elliotson resigned in 1839 his Professorship in University College, London; and he ceased at the same time to be physician to the hospital. Had he not been a man of great independence of mind, he might have been compelled to succumb to the cabal raised against him. Not only did he sacrifice the emoluments derived from the hospital and the professorship, but his practice as a physician was, at least for a time, seriously injured."

Such is a slight sketch of the "History of Mesmerism" in recent times, which will serve to give the reader some idea of the obstacles it has had to contend with; and especially the mean, unphilosophic, and thoroughly disgraceful conduct of many of the medical men in this country. We cannot omit the opportunity of testifying our admiration of the firmness and real love of truth and science, which Dr. Elliotson has shown in his patient and persevering championship of a cause which has cost him so much, both in a pecuniary and social point of view. But the time is rapidly approaching, if not already come, in which full justice will be done him by the scientific world —by all, indeed, except those who, to their eternal disgrace, have acted towards him in the cowardly and dishonourable manner to which we have alluded.

We shall now proceed to quote from the Preface to the work of Dr. Gregory which we are about to notice.

"The following letters were projected,

the plan sketched out, and a part of the work written in the latter months of 1849. But the translation of 'Reichenbach's Researches on Magnetism,' and other labours, besides my absence abroad in the summer of 1850, have retarded its completion. This I do not regret; first, because in the interval Mr. Lewis and Dr. Darling, whose interesting experiments are fully noticed, have visited Edinburgh; and, secondly, because, partly in consequence of this, many of our scientific men have become convinced that there are many facts in animal magnetism too long neglected, which *must* be investigated. Indeed, several of them have actually commenced observations on the subject.

"In later times, animal magnetism was first prominently brought before the British public by Mr. Colquhoun in his 'Isis Revelata,' and other interesting works. But these works did not produce all the effect which might have been anticipated from the great learning and research they displayed, and the clear logical style, and temperate tone in which they were written; perhaps because Mr. Colquhoun being a lawyer, and not a professed man of science, he may have been erroneously supposed, without investigation into his works, to be too credulous in this matter. Subsequently Dr. Elliotson took up the subject, and has in spite of much opposition, especially from his professional brethren, persevered in the practical study and application of animal magnetism, with a constancy and devotion to truth that do him the highest honour. A considerable number of medical men have in the course of time rallied round him, and have, like him, recorded their observations in periodical works, especially in the *Zoist*." * *
"It might be supposed that the works above mentioned" (namely of Townshend, Sandby, Scoresby, Martineau, Braid, Haddock, Esdaile, and Mayo) "would have spread abroad a general knowledge of the subject, and would have had the more effect because a large proportion of them proceeded from medical men, well qualified to investigate such a subject. But whatever may have been the cause of it, nothing is more certain than that a knowledge of animal magnetism has hitherto, in this country, been confined to a few, and that it is in the medical profession that the fiercest opposition has been met with.

"In every society or company, the large majority do not even profess to have studied it, *although that does not prevent many from expressing tolerably decided opinions.* [Do not the words we have put into italics convey a most cutting satire?] And we find, even among such as have paid a little attention to the subject, many ideas and views which are quite erroneous. In point of fact, therefore, a new work on animal magnetism is far from being superfluous; and it is hoped that this humble effort may have its use, were it merely in exciting the attention of some, and correcting the false impressions of others. It makes no pretension to a full and systematic treatment of the vast subject; and its only object is to convince the reader that there exists, in Nature, a multitude of most valuable and interesting facts, which in spite of their appearing strange and incredible at first sight are true, and, being so, demand and deserve the most patient, and complete investigation. * * * *
There are various indications that the time is approaching, when the subject must receive the attention it deserves from men of science in general. Within the last ten years there has been a growing interest in it, in all quarters, which is now reflected in the changed tone of many of the leading periodicals. But, besides this, scientific men begin to feel that they must attend to it, or be left behind. Perhaps this feeling has been considerably strengthened by the appearance of the work of Reichenbach, of the first part of which, the most material to this subject, I published an abstract in 1846. In this work, without making any observations on the mesmeric sleep, but simply by studying, in the most strictly physical manner, the action of magnets, crystals, and of the hand, &c., on the human frame in the waking state, the author has demonstrated the existence of a power,

distinct from all known influences, pervading universal nature, and capable of producing marked effects on healthy persons in the ordinary waking state. It was easy to see that Reichenbach, by following a different route, had discovered the same mysterious agent which Mesmer had called animal magnetism; and that, while some of Mesmer's theories were probably fallacious, yet the main *facts* had been fortified by these new observations, made in a manner so different, and, scientifically speaking, so satisfactory. Such, at least, was the impression which the study of Reichenbach's work produced on my own mind. I felt that, sooner or later, the whole subject would be investigated in the same way; and in the meantime, I was desirous to satisfy as many persons as possible, not only that certain most curious facts existed, but that they would all, in time, admit of a natural explanation." (Preface, pp. 1—8).

Now, when a man like Reichenbach, universally acknowledged to be one of the most careful and cautious of experimental philosophers, undertakes the investigation of a subject in this strictly inductive method; when his results convince such men as Berzelius, the father of modern chemistry, and Dr. Gregory, one of its most able professors—men who have stood in the highest rank as careful and cautious experimenters all their lives; when such men as Sir David Brewster are compelled by sheer force of direct evidence of their own senses, to admit the truthfulness of these extraordinary phenomena; is it too much to ask the *learned* and *scientific* Mr. Wakley, and the other medical grandees who swear by him and his *Lancet*—is it, we say, too much to beg of even these infallible autocrats of science, to suspend their sneers and allow ordinary mortals to attach some little weight to the evidence of their own eyes? We fear it *is* too much to ask anything so unreasonable. Although these doctors confess with one breath that they have never investigated the subject for themselves, and with the next breath admit their almost complete ignorance of the laws of organic life or nervous phenomena,—they yet strenuously refuse to credit the assertions of anybody else, no matter how trustworthy and sober-minded, who professes to have witnessed the facts for himself. It certainly matters very little, so far as these worthies themselves are concerned, what they believe or what they disbelieve. But the misfortune is, that so many other people who pin their faith implicitly on such blind guides, are prevented from examining for themselves. Let the doctors stick to their pills and black draughts, and welcome; science will lose nothing by the absence of such ignorant and bigoted people. But it *is* vexatious to think that the cause of truth should be retarded, though only for a moment, through their contemptible obstructions.

And this conduct is the more inexcusable, when we remember that almost every one may convince himself by experimenting for himself. Animal magnetism or mesmerism is, in the strictest sense of the term, an *Inductive* and *Experimental* science. There is perhaps no branch of physical science in which fewer *theories* have been hazarded, or more cautious experiments made. Mesmer himself promulgated a theory—but very few of his followers, or of modern mesmerists have troubled themselves much about this, or any other *theory*. And, what is curious enough, it is this very absence of theorising which brings down upon them a large portion of the abuse which the doctors aforesaid have lavished on them. "We cannot understand the *modus operandi*," say they: "We want some rational and philosophical explanation of all these strange things, before we can consent to believe them." And in this precious outcry they are joined by the Reverend Hugh M'Neile, of Liverpool, who actually preached and published a sermon, in which, admitting the facts of mesmerism, he attributes them decidedly to "Satanic agency," simply because he, good Paddy that he is, cannot tell *what other* agency to ascribe them to.

This is amusing enough. We congratulate Messrs. Wakley and Co., on their ally

in this anti-mesmeric crusade. It is a new kind of "Evangelical Alliance" certainly; but the doughty heroes differ slightly in one rather essential point; for whilst he of the *Lancet* flatly denies that there are any facts at all such as the mesmerists assert, his brother in arms—he of the *Penny Pulpit*, *with equal flatness* bemoans them as only too true, and as the undoubted work of the Devil. The *Lancet* wanted a theory—and the Liverpool Preacher has furnished him with a very simple and intelligible one. There is only one difficulty about receiving it—and that is the fact that *all* mesmeric experiments have a decidedly beneficial object, and more than nine-tenths of them a surprisingly good effect on the health of the persons operated on. If then, the Devil is at the bottom of these processes, he has come out in quite a new character. He must have turned over a new leaf, and began to do good instead of evil. So great has been the influence of this outrageously absurd and ridiculous "Sermon" on some weak-minded folks, that Mr. Sandby—a clergyman of a far different stamp and intellect, has actually found it necessary to enter somewhat fully into arguments to show its unutterable folly and stupidity. This he has done in one part of his excellent work, "Mesmerism and its Opponents," which we cordially recommend to the notice of our readers as containing a vast amount of most curious and interesting matter, and being written in a thoroughly philosophical spirit.

We have said that almost every one may attain satisfaction and conviction by his own experimenting. A few words on this point from Dr. Gregory's Preface, will not be out of place. After stating that his attention was called to the subject as early as 1827, and that he had read several works on it, he proceeds:—"The perusal of these works convinced me that there were many extraordinary facts, which it was the business of men of science to investigate; and from that time I continued to read all the works on animal magnetism I could find. But it was not for a long time that I was enabled to see any of the phenomena. I was under the erroneous impression that the power of producing them was confined to a few, and consequently did not myself try to do so. I took every opportunity, however, of seeing them as produced by others, both in public and private, but for a long period these opportunities were few, and the higher phenomena did not occur. At length, I think about 1842 or 1843, when I resided in Aberdeen, I found that I could produce the magnetic sleep in persons in whom it had already been produced by others. In some instances in which I tried to produce it for the first time myself, I failed, no doubt from want of perseverance, and thus I was still dependant on others for cases. But after a time, I found that I also, with the help of patience and perseverance, could produce the magnetic sleep, and many other phenomena. My professional engagements, however, prevented me from studying many cases, and it was only by slow degrees that I was enabled to see, in my own experience and in that of others, almost all the phenomena of Animal Magnetism. I now found that it was not difficult to produce the magnetic sleep, and that if we only try a sufficient number of cases, we are sure to meet with some in which the higher phenomena appear. Had I been able to devote my whole time to the subject, instead of only an insignificant fraction of it, I should long ago have met with all those things which I have only seen by slow degrees."

Contrast this truly scientific patience and perseverance with the conduct of the London persecuters of Dr. Elliotson, and others, who, because, forsooth, they had condescended to bestow a few hours' attention to the subject, and had not been quite satisfied in that period—took it upon themselves to denounce as liars, fools or impostors all those who, like Dr. Gregory, had become convinced of the truth by long years of patient observation!! But we proceed with the extract:—"But, in justice to those who have laboured and written on the subject, I must here state, that even when I

was unable myself to see, or to produce, the higher phenomena, such as those of clairvoyance, I considered the published evidence as amply sufficient to establish the facts. I found it quite impossible to reject the consistent testimony of so many able men, in all parts of the world, as to the existence in the magnetic sleep, of powers, which in our ordinary state, we do not possess." The limits of our present article, will not allow of our quoting more from this Preface, or from the work itself, which we would gladly do. We hope to have an opportunity of recurring to the subject in a future Number, and then to present our readers with further extracts. In the meanwhile, we recommend Dr. Gregory's book most strongly and sincerely to every one of our readers who possess a particle of interest in the subject. They will find it one of the most fascinating and absorbing which they ever read. We say this, without any intention to undervalue the numerous other books on the same subject which have lately appeared in such rapid succession. There are plenty of pamphlets, and very cheap "manuals" containing directions for producing the mesmeric phenomena (Buckland's, or Barth's, for instance), and we recommend these to such persons as cannot afford the more expensive treatises.

We caution our readers against forming any opinion from the mere attendance at *Public Lectures* on Mesmerism. These must always be more or less unsatisfactory. Nothing but private experiments, on persons well known to yourself, and where there cannot be the slightest possible suspicion of deceit or mistake—nothing short of this is satisfactory. We have not the least hesitation in asserting that there is no man who has made a dozen, or even half a dozen such private experiments, in a candid spirit of inquiry, who has not been most fully and thoroughly convinced thereby.

To our scientific readers we would especially commend the study of this new branch of physical inquiry. At no previous period has it been so earnestly and extensively entered into, as at this present moment. "It is very gratifying to me," says Dr. Gregory, "to be able to say, that men of the highest ability, and already distinguished in various difficult branches of science, are now turning their attention to this hitherto neglected subject; and I have had the greatest pleasure in placing it in the power of some of these gentlemen to see phenomena, which, I was sure, once seen, would never cease to interest them. * * * * * When such men as Sir David Brewster, Sir W. C. Trevelyan, Sir W. Hamilton, Dr. Simpson, Professor Forbes, Professor Bennett, and Professor Goodsir—when men like these, veterans in science, though some of them are young in years, besides many others have not only seen the facts, more or less extensively, but admit their importance, and have personally investigated into some of them, the time cannot be distant when the subject of animal magnetism shall assume a truly scientific form."—P. 210. The advocacy of Professor Gregory alone is likely to be of immense influence, from the position he occupies in such a University and Medical School as Edinburgh. The appearance of this work of his, is another deadly blow at the lingering obstinacy and bigotry of such men as the editors of the *Lancet*, and other medical journals.

BORLAND'S PATENT IMPROVEMENTS IN LOOMS.

(Patent dated November 2, 1850. Patentee Mr. John Borland, of Norfolk-street, Strand. Specification enrolled May 2, 1851.)

Specification.

My improvements in weaving machinery consist in certain additions to the power loom, whereby that machine is rendered more simple in its construction and easier to be worked, and have relation, *first*, to the mode of effecting the movement of the headles; *second*, to the picking or throwing of the shuttle; and, *third*, to the taking up of the cloth.

Figs. 1, 2, 3, and 4, of the drawings represent so much of a loom constructed according to my said invention as is necessary to show my improvements. Fig. 1 is a front elevation; fig. 2 a plan; fig. 3 and fig. 4 end elevations; the framing being in each case omitted.

Movement of the Headles.

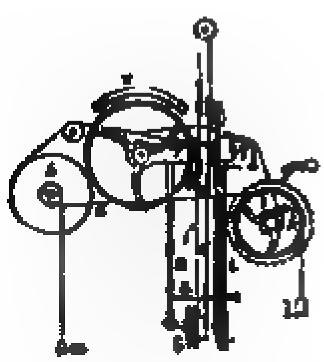
A A is the mainshaft. B the fly-wheel. C the driving pulley, which is put in motion by a belt from some prime mover. The inner edge of the pulley C is made of considerable thickness,

Fig. 2.

Fig. 5.

so that it may act as an assistance to the fly-wheel. D is a diagonal grooved pulley, which serves as a wiper to give motion to the upper end of the lever E, which has its fulcrum or axis at F. The upper end of the lever has a friction-wheel *a* mounted upon it, which takes into the grooves *b b* of the wiper pulley D, by which the top of the lever is made to oscillate from side to side. The amount of travel thus given to the lever is equal to the distance between the centres of the grooves *b b*. Fig. 5 is a plan of the periphery of the pulley cut across and spread out in a straight line; it is so represented that the whole of the grooves may be exposed to view at once. From this it will be seen that the lever E is kept steady in one position during the greater portion of the revolution of the main shaft, that is, while the friction pulley *a* is moving along the parallel portions *b b* of the grooves, and performs its oscillation or change from side to side when the pulley *a* is making its pass over the diagonal portions *b′ b′*. The proportionate lengths of the parallel and diagonal portions of the grooves, as also their positions upon the main shaft, are

Fig. 3. Fig. 1. Fig. 4.



so disposed in relation to the other parts of the machine that the lever *e* is made, with the help of the other arrangements next to be described, to effect the movement of the headles just at the proper intervals of time. G G are two pulleys or riggers, which are connected together by a band H, which is fixed to the peripheries of both riggers, so that they must both move together. The lower end of the lever *e* is attached to the band H, so that at each oscillation which it makes, the riggers G G are caused to make part of a revolution. I, *I*, I², I², are four cords, the lower ends of which are affixed to pins projecting from the surface of the riggers, while their upper ends are attached to the headles K K, by which arrangement their alternate rising and falling is effected every time the riggers are moved.

Picking or Throwing the Shuttles.

L L are two levers, the lower ends of which move on a stud fixed in the rocking tree; their upper ends are passed up through the lathe to which the picker is connected, whereby motion is communicated to the shuttle. These levers are acted on alternately at each revolution of the main-shaft by movements produced in the several parts following: M M′ are two upright spindles, the lower ends of which are stepped in bearings formed in a cross-rail N, and their upper ends passed through slots *x x*, formed in the top rail, into which slots they are capable of being moved from one side of the machine towards the other, and to such a distance as is sufficient to disengage the friction rollers *c c* placed upon the arms O O, and prevent them from coming into contact with the

cams P P keyed to the main shaft. The friction rollers *c c* are drawn into gear with the cams P P by means of the helical springs R R, and are again drawn out of gear by the bands S S, which are attached to the upright spindles M M by means of collars *d d*, to which the helical springs R R are also attached. Every time the lever E makes a move towards either side of the machine (by means of the wiper pulley before explained), it causes one of the friction pulleys *c* to gear upon the cam P, in which position, as the cam revolves, it causes the upright spindle M to make a partial revolution, and suddenly bring round the lever arm Q, which is affixed to the spindle M. $R^2 R^2$ are bands which connect the ends of the arms Q Q with the levers L L, so that when the arm Q is sudenly drawn round as has just been explained, the lever L is caused to effect the throwing of the shuttle.

Taking-up of the Cloth.

The main shaft A has its bearings in two levers T T, one placed at each end of the machine, which have their axis at *e e*. U is a lever or handle, being a continuation of one of the levers, which is loaded with a weight V sufficient to counterpoise the main shaft and the gear which is upon it. When the frog W, which has a notch upon one side of it for the reception of a pin in the lever, is drawn back, it allows the lever to fall down, and the driving pulley C to rise up till it comes in contact with the break X, which slackens the driving band supposed to be coming from above, and thus stops the machine. The frog W is kept in its place by means of a helical spring *f* and the handle f^2. Y is the breast beam, which is of the peculiar curved form, shown in figs. 3 and 4. The upper edge is presented in a slanting direction to the reed, and set up like a file, by which it takes a hold of the cloth as formed, keeping it the width of the length of the reed. I am thus enabled to dispense entirely with the use of a temple. The breast beam is fixed to the sides of the frame by means of two studs, upon which it is free to move when any extra pressure is brought to bear against its front edge. If the shuttle should happen to miss completing its full journey, and stick in the warp, then, when the lathe moves forward, the breast beam will move back, turning upon the pivots upon which it is placed, and thus prevent the breakage of any of the parts of the loom, as well as any damage to the web. The movement so given to the breast beam farther disengages the frog W from its hold of the lever U by pressing back the arm *g*, which forms a part of the frog, upon which the lever U falls and stops the loom. *h* is the warp beam, *i* the cloth beam, *k k* the ratchet wheel and pulley; *l* a weight for causing the cloth to take up upon the beam as it is formed; *m* another weight, which causes the cord *n* to have the requisite friction upon the beam. The taking-up motion thus receives the cloth upon the beam as it is struck forward by the lathe, so that if the shoot should happen to break, and the loom continue to go on, no flaw will be thereby formed in the cloth on again starting, as the warp will not have advanced.

Claim.—The power loom above described, in the peculiar arrangement, disposition, and combination of parts of which the same consists; that is to say, in so far as regards the employment of only one shaft, and that shaft moveable upon levers placed upon the frame—the double wiper pulley in immediate connection therewith, and the parts for moving the treadles or shades—the moveable breast beam toothed upon its upper edge, and placed close to the reed, whereby the temple is dispensed with—the taking-up motion, by which flaws or other defects in the cloth are prevented in the case of the shoot breaking—and the arrangements connected with the breast beam for stopping the loom in case of the shuttle resting in the shed during its passage across the loom.

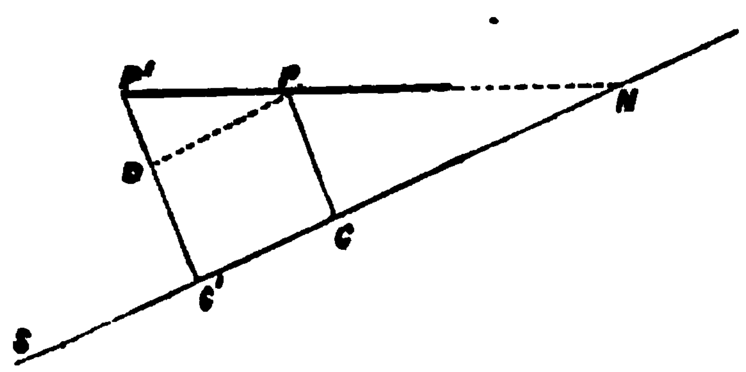
THE ROTATION OF THE EARTH.

Sir, — In my last communication I gave a very simple investigation of the more striking phenomena of M. Foucault's pendulum experiment. I now proceed to establish the following interesting deduction, namely—

The length of the arc, of the rim of the table, subtending the angle of deviation at its centre, which a pendulum, oscillating over it makes during one revolution of the earth, is exactly equal to the difference between the parallel of

latitude described by that centre, and the parallel described by the extremity of the meridional diameter of the table.

Let P be the centre of the table, PP′ half the meridional diameter, NS the axis of the earth; PC, P′C′ perpendiculars upon it, and PD parallel to NS.



Then, by what has been already proved (p. 353), the angle of deviation in one revolution of the earth $=360°$ sin. N.

$$=360°\frac{P'C'}{P'N}=360°\frac{P'D}{P'P}.$$

This angle multiplied by the radius PP′ of the table, and by 3·1416, and divided by 180°, is the arc of the rim of the table subtending it: that is, the measure of this arc is 2 P′D × 3·1416. But twice P′D is the difference of the diameters of the two parallels described by P and P′. Hence the arc that measures the angle of deviation in one revolution of the earth, is equal to the difference of the two circumferences described by P and P′. And the arc of deviation due to any portion of a complete revolution of the earth, is equal to the difference of the two portions of parallels described by P and P′.

The same conclusion may be obtained by aid of considerations still more simple. It is plain that the difference between the circumferences of any two equidistant circles, on the surface of a cone, is always the same: hence if a circle be described about the apex, with a radius equal to PP′, the circumference of it will be equal to the difference between the two circumferences described by P and P′; but this same circumference, when the cone is developed, is the arc of deviation on the table due to a complete revolution of the earth: hence this arc must be equal to the difference of the two parallels described by P and P′ in a complete revolution.

From what has now been proved, it follows that the pendulum experiment affords not only ocular demonstration of the rotary motion of the earth, but that it moreover exhibits to us the actual velocity, in linear measure, with which the point P′ proceeds in advance of P. It is the velocity with which the arc of deviation increases.

It may be added, finally, that if the length of this arc, described in any interval of time, be measured, we may readily deduce the arc that would be described in a complete revolution of the earth. If the length of this be taken for the circumference of a circle, the diameter of that circle may be inferred: this diameter, applied as a chord to the circle of deviation, will subtend an arc, the degrees and minutes of which will be double of the latitude. And in this way might a person make out his latitude if placed in the circumstances imagined at p. 326.

I am, Sir, yours, &c.,
J. R. Young.

May 5, 1851.

THE ROTATION OF THE EARTH.

Sir,—All the writings I have seen in support of the assertion that the rotation of the earth has been rendered visible, seem to require, at least, one of two things to be granted—either that the plane of vibration of a pendulum remains fixed in space, or that it can be shown that the earth may have a circular motion round a variety of points on its own surface.

As it may be easily shown that, under certain circumstances, a pendulum must vibrate in a horizontal plane in order to preserve its parallelism to the plane of its first vibration, it is perhaps unnecessary to say more on this part of the subject.

"But," say other parties, "we can show that the earth moves round any pendulum we please to hang up." Well, we will see what they can do, and take their own word for it.

We have been told, that "it is well known to geometers that a rotation of a rigid body about one axis may be ideally separated into two smaller rotations about any two axes at right angles to one another, lying in a plane passing through the first; the rotation of the earth about its pole may accordingly be supposed to be replaced by two simultaneous rota-

tions about two ideal poles, one running straight up under the place of observation, the other passing through the earth's centre at right angles to the former." Very good: but what then? The "two smaller rotations" would, according to the enunciation, produce precisely the same effect that the one natural motion now produces; and that this fact should have been lost sight of, is to me most amazing. But that it has been lost sight of, is indisputable; for the explanation proceeds as if these two imaginary rotations were real ones, and also as if either could be used separately from the other; and the writer presently tells us that, "the principal, and I may say total, observed effect, will be due solely to the rotation about the ideal pole, which is on a line with the point of suspension." But there is not even a supposed rotation about this imaginary pole, except in combination with another supposed rotation; and the combined rotations about the two imaginary poles would, as before stated, produce precisely the same motion as now exists, and to believe otherwise is tantamount to assuming we can give the earth as many separate axes as we please. To crown the matter, we are assured that "the motion is the result of a rational and mathematical investigation," and therefore, of course, is not dependent on or connected with the natural motion of the earth.

That rational men should mystify themselves into belief in such statements as these, seems to me very funny; but as if to give zest to the joke, it is complacently intimated that there are mysteries in these matters which can only be properly comprehended by the "elevated few."

Unless the asserted manifestation can be better explained, I think we are justified in concluding that if the rotation of the earth *can* be rendered apparent to the senses, it yet remains to be done.

I am, Sir, yours, &c.,

S. Y.

(An Engineer.)

May 2, 1851.

P. S.—Since writing the above, I have seen in your pages the very lucid explanation given by Professor Young of the manner in which he conceives the asserted effect is produced; but it has not altered my opinion.

We may imagine the graduated table over which the pendulum vibrates fixed to the imaginary cone, and we shall see at once that the table can have no motion except *with* the cone, and that a line drawn from the apex of the cone through the centre of the surface of the table, will point to the apex of the cone during the whole twenty-four hours. It is equally clear that if the pendulum be started so as to vibrate over this line, and should afterwards vibrate in some different direction, the change must be in the plane of vibration, and not in the table. But Professor Young considers, if I rightly apprehend him, that the pendulum would continue to vibrate in the plane of the meridian, and therefore, as it appears to me, over the line I have spoken of.

Possibly, if my view of the case is erroneous, the Professor will do me the favour to explain in what it is so.

S. Y.

May 6, 1851.

THE ROTATION OF THE EARTH.—PROPOSED REPETITION OF M. FOUCAULT'S EXPERIMENT AT THE EQUATOR.

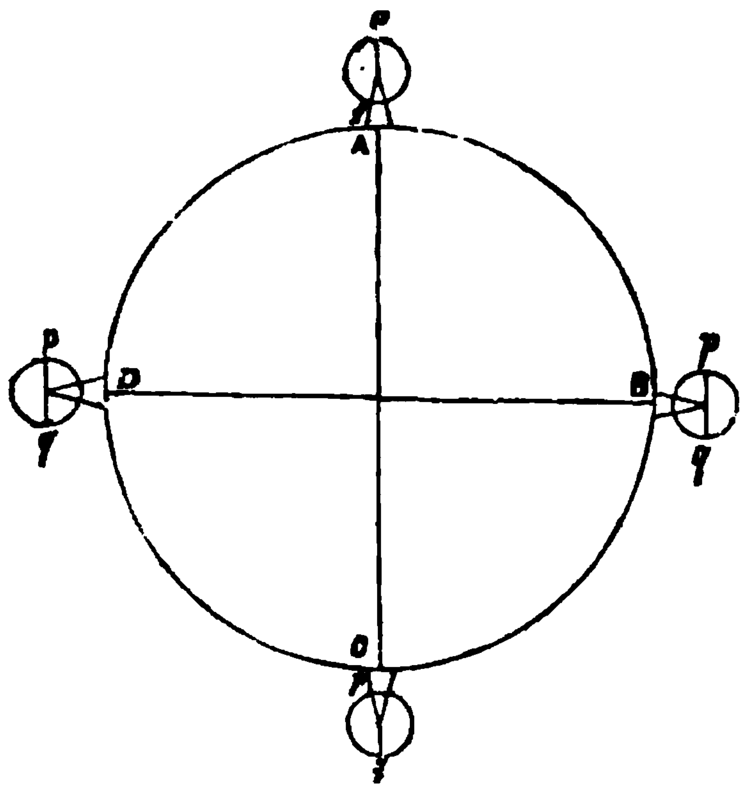
Sir,—If the French experiments for showing the diurnal rotations of the earth were repeated at the equator, of course the pendulum would not exhibit any such rotation, but continue to vibrate on the same line over which it was first started.

It has occurred to me that the experiment might be varied in such a way as to show the earth's rotation at the equator, as well as it has been shown by M. Foucault's experiment at Paris.

If at the equator a circular disc of uniform density be mounted, so that its axis rests unpon bearings, the friction of which is reduced to the smallest possible degree, and placed so that the plane of the disc may be in the plane of the equator; then, in reference to its rotation on its axis, in whatever position it is placed it will remain absolutely at rest—that is to say, gravity will have no tendency to make it assume one position rather than another.

Let the circle in the figure represent the equator, and let the disc be placed at A, and let the diameter *pq* be vertical; now, if the earth revolves, so as to bring the disc to the position *B*, if the tem-

dency of the disc is to remain absolutely at rest with relation to its revolution on its axis; that is to say, if the diameter



pq continues to point to the same part of the heavens that it did at starting, it will then appear to be horizontal, and the point *p* will appear to have travelled through an arc of 90°, at C it will have travelled through 180°, at D 270°, and on its return to A, that is in twenty-four hours, it will have completed the circle. To complete one revolution in exactly twenty-four hours, it would of course be necessary to get rid of friction altogether.

Your obedient servant,

Z.

Athenæum Club, April 26, 1851.

A RED-HOT SOLID COLUMN OF WATER.

The experiments of Mr. James Thomson, of Glasgow, and Professor W. Thomson (see *Mech. Mag.*, vol. liii., p. 486), seem to have established it as a law of nature that water, and all bodies which expand in solidifying, liquify or solidify at a degree of temperature proportionate to the pressure to which they are subjected—the ratio of temperature to pressure being, in the case of water, one-tenth of a degree Fahr. for every 10 additional atmospheric pressures. Professor Cresson, of Philadelphia, has founded on this the following curious speculation (Proc. Am. Phil. Soc., 15th Nov., 1850):—"If a continuous channel admitting atmospheric communication should exist in the crust of the earth to the depth of seventy miles, the pressure of the atmospheric column would exceed fifteen million pounds on the square inch, and water would remain solid at a temperature above 10,000°, which far exceeds that of molten iron."

ELECTRO-MAGNETIC LOCOMOTIVE.

The *National Intelligencer*, of New York, states that Professor Page has at length, under the patronage of the United States' Government, constructed an electro-magnetic locomotive, with which a trial was made on the Baltimore railroad; but that the utmost speed attained on a level was only ten miles an hour. The engine weighs 10½ tons, and has five-feet driving wheels, with two-feet stroke.

UTILITY OF DESIGNS ACT.

Court of Queen's Bench, 26th April, 1851.

THE QUEEN *versus* BESSELL.

This was a conviction for the infringement of a design for a window ventilator, registered under the provisions of the 6 and 7 Vic., c. 65, which had been removed by *certiorari* into this Court, and now came on for argument upon a rule to quash it, upon the ground that the design was not within the meaning of the Act, and therefore the magistrate had no jurisdiction to convict. Various questions were raised by the rule, but the only one argued was, whether or not the design in question was such as could be registered under the Act.

Mr. Hindmarch and Mr. Locke appeared in support of the conviction. The ventilator in question was one in which a pane of the window is opened outwards by means of a string which passes over the head of a screw, and thereby turning it, opens the pane as much or as little as is desired, there being a half pane placed within the whole pane, so as to direct the current of air upwards, and prevent it from blowing down into the room. And the only difference between the registered ventilator and that which was said to be an infringement of it was, that in the first the screw was straight with a joint, and in the latter slightly curved. In the description registered under the Act, the claim for protection was stated to be not in respect of the shape or configuration of any of the parts, but in the configuration or combination of the whole. It was now contended that the fact that this might be the subject of a patent was no reason why it should not also come within the provisions of this Act, and that was decided in the case of "Rogers *v.* Driver" (20 *Law Journal*, Q. B. 30), by which case a very wide construction was put upon the Act. There could be no doubt that this design had reference to a purpose of utility. The only question, therefore, was, whether it was for "a shape or configuration" within the meaning of the Act—the word "configuration" being, in Dr. "Johnson's Dictionary," defined as meaning

"the form of the various parts of any thing as they are adapted to each other." The various parts of the design were in themselves old, but new with reference to their application and adaptation to each other for the purpose of producing a ventilator; and, therefore, there is in the design a new configuration within the meaning of the Act.

Mr. Justice Earle—Suppose the pane in that which is called the infringement, was made circular, instead of oblong, that would clearly be an infringement of a patent for this ventilator, but it would be also an infringement of this registered design?

Mr. Locke—I think it would not.

Mr. Webster, contra, said he should confine his argument to the meaning of the words in the statute, "shape or configuration," and should contend that this was a registration of a combination of known configurations, and not itself a configuration within the meaning of the statute, for the shape or configuration of the whole thing had no reference to its utility. In the case of "Margetson *v.* Wright," in the Court of Chancery, it was sought to bring in "the Protector Labels," within the Act, but the Court said, "where is the shape or configuration which is essential to its utility? for it is clear that if you cut off the corner of the label it was just as useful," and so here if the ventilator is made round its utility is not impaired.

Mr. Justice Patteson—It appears to me that the very description put by the inventor upon the certificate of registration is "felo de se," because it expressly says that the part or parts which are not new or original, are all the parts, and that which is claimed is the combination, that therefore is not shape or configuration. I pretend not to say exactly what the word "configuration" means, but it must be taken in conjunction with "shape." The design must be for a thing of some particular shape, and the latter word, it appears to me, can add but little to the former. Here the claim is for the putting together several things, and by opening a pane of a window more or less, to ventilate an apartment, and therefore it is very rightly said that it is the combination which is new; but that is not protected by the statute.

Mr. Justice Wightman—I have been at a loss, all through, to discover in what way the shape or configuration of this article has anything to do with its utility.

Mr. Justice Earle said he thought that the invention was not within the statute. If the prosecutor relied on "shape and configuration," there was no infringement, for the one was nearly square, the other very oblong: the one had a curved, and the other a straight screw. If he relied on the combination, then this statute would not protect him, but he must seek protection under the patent law.

Conviction quashed.

Mr. Hindmarch then applied that it might be made a condition that no action should be brought against the magistrate.

Mr. Webster opposed this.

Mr. Justice Patteson said it was a question of law and of some doubt, and the matter ought not, therefore, to be carried any further.

UNSEALED PATENTS.

New Order by the Lord Chancellor.—"It is ordered that before any letters patent for inventions shall be passed under the Great Seal, there shall be deposited with the Privy Seal Bill, at the Great Seal Patent-office, a certificate by the Attorney or Solicitor-General, that an outline description in writing or drawing of the invention has been filed with them, or one of them. Dated the 2nd May, 1851.—(Signed) TRURO, C.—Great Seal Patent-office."

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 8, 1851.

JOHN MATTHEWS, of Kidderminster, foreman. *For improvements in sizing paper.* Patent dated November 2, 1850.

Mr. Matthews describes and claims three arrangements of apparatus, each on the same principle. The paper, either in sheets or webs, is let in between two endless bands of felt or other suitable material revolving in contact, by which it is carried through a trough containing size, and delivered at the opposite end of the machine. The delivering rollers are weighted, so as to squeeze back the excess of size into the trough.

ARCHIBALD SLATE, of Woodside Iron Works, Dudley *For improvements in canal navigation.* Patent dated Nov. 2, 1850.

The improvements here claimed comprehend,

1. A system of vertical equilibrium lifts, in which tanks or caissons are employed for raising, lowering, and transferring boats, either loaded or empty, from higher to lower levels on canals.

2. The employment for canal boat propulsion of compressed air issuing from a nozzle at the stern of one or more of a line of boats at a velocity slightly greater than that at which the boats are required to travel.

PIERRE ANTOINE AUGUSTE DE NANTEUIL, of Leicester-street. *For improvements in propelling carriages.* Patent dated November 2, 1850.

These improvements consist in the application of direct impulse for the purposes of propelling carriages on common roads and railways. No claims.

JOSEPH CHRISTIAN DAVIDSON, of Yalding, Kent, brickmaker. *For improvements in lime and other kilns and furnaces.* Patent dated November 2, 1850.

1. Mr. Davidson's improvements have relation to lime kilns, in which, as usually constructed, the fire has been lighted in the kiln underneath an arch built of the limestone to be calcined. According to this method a great waste ensues from pieces of the stone chipping off by the action of the heat and falling into the fire, from which they have necessarily to be removed. It is now proposed to have the fire-place alongside of the kiln, and to conduct the flame and products of combustion through the side of the kiln, to act upon the limestone, which is to be piled in the kiln on an arch built in the usual manner, and so as to act as a reticulated flue.

2. The same principle is applied to the kilns used for baking bricks, the fire-places being arranged at the side of the kiln, in such position as to make the openings in the walls thereof the throats of the furnaces.

VICTOR EMILLE WARMONT, of Neuilly, Seine. *For improvements in dyeing wool and other fibrous materials and fabrics.* Patent dated November 2, 1850.

In dyeing hanks of thread or yarn of different shades, the hanks are stretched over a frame in which are placed a number of transverse wooden slips of different sizes, covered with felt or other suitable material, and saturated with colour of any desired shade, and at any required distance apart. A similar frame is then superimposed on the other, and the two tightly clamped together. The frame is then immersed in the dye-vat until the desired depth of colour is produced. Or, a number of these frames may be clamped together, and the whole immersed in the dye-vat.

No claims.

JONAS BATEMAN, of Upper-street, Islington, cooper. *For improvements in life-boats.* Patent dated November 2, 1850.

The life-boat which forms the subject of this patent is flat bottomed, and has her deck pierced with a number of circular apertures, for the insertion of cylinders of sufficient size for a person to stand in, which are left open at top, and firmly secured by bolts to the bottom of the boat. The interstices between the cylinders are filled with prepared cork, and each cylinder is provided at top with some waterproof material to be fastened around the waist of the person occupying it, so as to exclude the water. A thick bar of iron forms the keel, and is attached to the boat by bolts which project above the deck, and are furnished with eyes to admit of the boat being raised out of the water when not required for use.

Claim.—The combination of the articles enumerated to form a life-boat which shall be perfectly secure in shipwreck.

JOHN TATHAM and DAVID CHEETHAM, of Rochdale, machine-makers. *For certain improvements in the manufacture of cotton and other fibrous materials and fabrics composed of such materials.* Patent dated November 2, 1850.

Claims.—1. In scutching machines, the application of an extra pair or pairs of rollers for delivering the material in succession to the action of the scutcher.

2. In lap machines—1. The application of a concave surface or surfaces, between which and a roller the material passes previous to its being wound into a lap. 2. The employment of a pipe or other suitable apparatus for conveying oil, or a substitute therefor, to wool in the process of being wound into a lap.

3. In drawing frames—1. The combination of a previously-patented coiling tube with a traversing can or other receptacle for receiving the slivers. 2. Distributing the slivers into cans by means of traversing rollers. 3. Distributing the slivers into cans or other receptacles by means of a reciprocating funnel or otherwise suitably-shaped guide. 4. The employment of apparatus for raising simultaneously the whole or a series of the weights used to give pressure to the rollers. 5. Constructing the bearings for the spools of the stop motion in series, by casting or otherwise, and placing such bearings within the back plate. 6. The application of a plate to the front drawing roller, for preventing the broken ends of the slivers from lapping round the rollers. 7. The employment of the action of the stop motion as a medium for separating the rollers. 8. Forming the revolving bar of the stop motion in one piece, instead of the ordinary moveable vanes. 9. Causing the feeler of the stop motion to vibrate so as to be capable of coming in contact with either side of a "tumbler." 10. With reference to Gibson's patent tumbler, causing the sliver to pass along the upper surface thereof, and also placing the tumbler in such a position that the back plate will receive a heavy sliver, and thereby relieve the tumbler of its weight.

4. In oiling wools. Effecting this pro-

cess within a revolving vessel, or a stationary vessel with moveable arms or other agitating apparatus.

5. In roving or slubbing frames—the application of a spring placed within the leg of the flyer and acting on the principal of torsion. 2. Making the spindles of cast metal hollow.

6. In throstle frames. 1. An arrangement of drums for driving the spindles. 2. Causing the yarns to pass through an eye or slot formed in the upper part of the flyer. 3. An arrangement of apparatus for breaking off a snarl when formed above the flyer. 4. The application of a partition in front of the frame in throstles or doubling frames. 5. Effecting the copping of the yarn by means of an annular guide traversing the whole length of the bobbin to be formed. 6. Forming the flanges of bobbins of different areas as regards their frictional surfaces. 7. Attaching a bristle or other light flexible substance to the flyer, in order to prevent dirt and dust from getting into the foot bearings. 8. The application of a pipe to the whole or a portion of a range of bobbins for the purpose of simultaneously lubricating the bearings. 9. Winding yarns in doubling or spinning on plates, or other receptacles instead of on bobbins as ordinarily practised.

7. In winding yarns for weaving. Transferring several yarns or threads on to one bobbin or spindle, and subsequently balling or winding this compound bobbin to form a warp.

8. In looms for weaving. 1. As regards Jacquard machines, the employment of two or more "knife boxes," or other suitable apparatus moving independently of each other, and capable of effecting a shedding of the warp alternately. 2. In looms generally—effecting the shedding of the warp by means of cranks or eccentrics. 3. The employment of a roller with cross groves, in order to effect the taking up of the work. 4. An arrangement of rollers to effect the same object. 5. The employment of cords or strands between which and a vibrating grate the shuttle passes in order to enable the weft to effect the taking-up motion. Also, making the cords or strands of gutta percha, leather, or varnished yarns or threads, when applied to the detection of the weft. 6. The employment of a grate vibrating on its own centre in order to arrest the motion of the loom, and prevent the continued taking up of the work in the absence of the weft. 7. The use of a grating as a part of the shuttle race when weft detectors are employed, in which an upright grid is used. 8. In looms in which the letting off of the yarn is effected by the pressure of the reed against the work, the application of the diminished amount of such pressure arising from the absence of the weft to the stopping of the loom.

9. In cutting terry woven fabrics. 1. The employment of cutters acting whilst the work is in the process of formation for cutting up the loops, whether produced by the terry wires or by any other method. But in the former case the employment of cutters independent of the wires. 2. An arrangement of cutters, in a spiral form, for cutting the loops when the work is finished and removed from the machine, such arrangement being applicable also as a modification of the preceding.

10. In machinery for finishing plush—an improvement upon an arrangement of apparatus previously patented by Cheetham and Briggs.

John Slate, of Wandsworth, accountant. *For improvements in stoves and furnaces, and in chimney-pots and regulators.* Patent dated November 2, 1850.

The first part of this invention consists of a series of improvements in the construction of "register" and other stoves, grates, and ranges which have for their object the cure or prevention of smoke, and the creation of a better draught in the chimneys of such stoves, grates, and ranges. The sides of the stove are composed of two plates or slabs hinged together at their inner edges, one being fixed and the other moveable, from the front of the grate towards the fire-box. When the moveable sides are drawn forwards, they increase the draught in front of the fire, and cause an additional current of air immediately under the flue on either side. The register plate, which partially encloses the top, is inclined upwards from the front to the back of the grate, and the remainder of the top is covered in by four triangular flaps, two of which are hinged to the moveable sides, and the other two attached to the front plate of the stove. A vane or smoke-director is placed in the throat of the chimney, and centred on a pivot at the back, so as to be capable of being turned either way, and thereby direct the current of smoke or air up a right or left-hand flue, as may be required.

The front of the stove is sometimes made of open work, behind which the moveable sides traverse; or, instead of this arrangement, a screen of open work may be attached to the front edge of each of the moveable sides, so as to be drawn forward when they are opened, and withdrawn from view when they are closed.

Mr. Slate, secondly, describes several improved constructions of chimney-pots, to be used either alone or in conjunction with the stoves or grates just described. One of these

has a cowl of a screw or spiral form, the threads of which are kept apart by stays, and has also sometimes a series of apertures formed in the pot. A second has a conical cowl, surmounted by a cylindrical stem with a hood, whilst three or more similar stems and hoods are attached to the cowl over suitable apertures therein; and the third form is an improvement upon a chimney-pot previously registered by Mr. Slate.

Claims.—1. The construction of "register" stoves or grates and ranges with double cheeks, one fixed and the other moveable, with the register plate inclined upward from the front to the back of the chimney, and with a shifting smoke director placed in the throat of the chimney.

2. The several constructions of chimney-pots represented and described.

Matthew Hodgkinson, of Red-street, Newcastle-under-Lyne, mine-agent. *For improvements in furnaces or apparatus for smelting ores and minerals, and for the making of pig iron.* Patent dated November 2, 1850.

Claims. — 1. Constructing furnaces for smelting ores and minerals and making pig iron, with an inclined floor, on which the charge of fuel and other material is supported under the action of the fire, the whole being so arranged as to admit the air to support combustion through the charging openings, to the upper part of the charge, the molten metal and scoriæ being allowed to run down the inclined floor to the pot, well, or hearth, from which they may be tapped off in the usual manner.

2. The combination with the inclined floor of a longitudinal opening and a chamber or channel below, and the method of admitting air to the top of the charge, and causing the same air to pass to the lower part of the charge (by means of a draught chimney), and thence to the chimney, after having acted on the incandescent fuel and semi-molten materials in the furnace.

William and Colin Mather, of Salford, engineers, and Ferdinand Kasselowsky, of Berlin, engineer. *For improvements in machinery for washing, steaming, drying, and finishing cotton, linen, and woollen fabrics.* Patent dated November 2, 1850.

Claims.—1. The employment of revolving and falling beaters with suitable number of sides, and also of squeezing rollers in combination with winches or rollers for the purposes of exposing loose folds or plies of cloth to the beating or squeezing operation for the purpose of washing.

2. A method of washing cloth in its full breadth by passing the cloth through narrow apertures through which currents of water are caused to flow.

3. The application of a steam engine in combination with, and for moving the cloth in steam chambers, by means of the waste steam which escapes from such chambers.

4. Constructing and arranging steam chests or boxes for drying goods, so as to form flues, the air in which is heated by the steam chambers and employed for drying purposes.

5. A combination of machinery for traversing a plate between two rollers on which the cloth to be finished is wound in connection with two parallel tables, which give the required pressure to the cloth, and also the application of plates with projections on their surfaces for causing indentations in the cloth while being so mangled.

6. A peculiar construction of cast iron gudgeons for securing the wooden rollers employed in washing and finishing machinery.

Benjamin Guy Babington, of George-street, Hanover-square, doctor of medicine. *For improvements in preventing incrustation of steam and other boilers.* Patent dated November 7, 1850.

This invention consists in the application of voltaic agency for preventing incrustation in boilers by connecting to the interior of such boiler a plate of some metal more susceptible of oxidation than that of which the boilers are composed, and in such a position as to be wholly immersed when the water in the boiler is at the usual level.

The patentee recommends for iron boilers a plate of zinc of the ordinary description, and of a weight of 16 oz. to the square foot, which should be attached by one of its edges, by means of solder, to the interior of the boiler, and that the proportion which such plate should bear to the immersed surface of the boiler should be one-fifteenth, reckoning one side only of the zinc plate. Both sides of the plate being left exposed to the action of the iron and the water in the boiler, the voltaic agency thus excited is found to produce the desired effect. For large boilers two, three, or more plates are recommended, the relative proportions above stated between the surface of the plate and that of the immersed portion of the boiler being maintained.

When the zinc plates are corroded, as they will be found to do, though but slowly, they are to be removed and replaced by others. (No claims.)

Specification Due, but not Enrolled.

Richard Clyburn, engineer to the firm of D. Maclean and Son, of St. George-street, East Middlesex. *For improvements in wheel carriages.* (Partly a communication.) Patent dated November 2, 1850.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in the manufacture of woven and felted fabrics. (Being a communication.) May 3; six months.

John James Greenough, of Washington, United States, America, esquire, for improvements in obtaining and applying motive power. (Being a communication.) May 3; six months.

Gaetan Kossovitch, of Middleton-square, Middlesex, gentleman, for improvements in rotary steam engines. (Being a communication.) May 3; six months.

Edwin Rose, of Manchester, Lancaster, civil engineer, for certain improvements in boilers for generating steam. May 3; six months.

Charles Cowper, of Southampton-buildings, Chancery-lane, for improvements in coverings for buildings. (Being a communication.) May 3; six months.

Peter Armand Lecomte de Fontaine noreau, of South-street, Finsbury, Middlesex, and 24, Boulevard Poissonniere, Paris, France, for improvements in the manufactu e of fuel. (Being a communication.) May 3; six months.

William Smith, of Upper Grove-cottages, Holloway, Middlesex, engineer, for improvements in locomotive and other engines, and in carriages used on railways. May 3; six months.

Pierre Armand Lecomte de Fontainemoreau, of South-street, Finsbury, London, and 24, Boulevard Poissonniere, Paris, for certain improvements in electric telegraphs. (Being a communication.) May 3; six months.

William Cooke, of 18, Gt. George-street, Westminster, Middlesex, civil engineer, for improvements in the manufacture of soda and the carbonate thereof. (Being a communication.) May 3; six months.

James Pyke, of Westbourne-grove, Bayswater, Middlesex, for improvements in the manufacture of leather; also in the making of boots and shoes. May 3; six months.

Alexis Delemer, of Radcliffe, Lancaster, civil engineer and machinist, for certain improvements in the application of colouring matter to linens, cottons, silks, woollens, and other fabrics, and to linen, cotton, silk, woollen, and other weft, and also in machinery or apparatus for these purposes. May 6; six months.

William Henry Brown, of Ward's-end Steel Works, near Sheffield, York, steel-roller, for certain improvements in the manufacture of helves. May 6; six months.

Thomas Robert Mellish, of Regent-street, Middlesex, glass manufacturer, for certain improvements in instruments and apparatuses for the admission and exclusion of light and air into and from buildings and carriages, and in the manufacture of reflectors of light; parts of which improvements are also applicable to the decoration of articles of furniture. May 7; six months.

William Edward Newton, of 66, Chancery-lane, Middlesex, civil engineer, for improvements in apparatus for the generation and condensation of steam for various useful purposes; also improvements in certain parts of engines to be worked by steam, air, or gases. (Being a communication.) May 8; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
April 30	2802	Charles J. Watson	Piccadilly	Utilis portmanteau.
May 1	2803	Rudhall and Co.	Birmingham	Penholder.
,,	2804	George Unite	Birmingham	Spring and chain fastening for bracelets.
3	2805	Thomas Wallis	Conduit-street, Paddington	Railway and exhibition passenger carriage.

The Great Exhibition.—*Owing to the delay in the publication of the Official Illustrated Catalogue, and in the complete arrangement of the foreign departments of the show, the Select Notices announced in our last are postponed for another week.*

CONTENTS OF THIS NUMBER.

Shepard's Patent Electro-Magnetic Heat, Light, and Motive-Power Producing Machines.—Specification.—(*with engravings*) ... 361
Gregory's "Letters on Animal Magnetism."—(Review) ... 364
Borland's Patent Improvements in Looms.—Specification.—(*with engravings*) ... 370
The Rotation of the Earth.—Deductions from Foucault's Experiment. By Professor J. R. Young ... 372
On the Same. By S. Y. (Engineer) ... 373
Proposed Repetition of Foucault's Experiment at the Equator ... 374
A Red-hot Solid Column of Water ... 375
Trial of Page's Electro-magnetic Locomotive ... 375
Utility of Designs Act.—Queen v. Bessell ... 375
Unsealed Patents.—New Order ... 376
Specifications of English Patents Enrolled during the Week:—
Matthews ... Sizing Paper ... 376
Slate ... Canal Navigation ... 376
Nanteuil ... Propelling ... 377
Davidson ... Kilns ... 377
Warmont ... Dyeing ... 377
Bateman ... Life Boats ... 377
Tatham & Cheetham ... Cotton Manufacture ... 377
Slate ... Stoves and Chimneys ... 378
Hodgkinson ... Smelting ... 379
Mather and Kaselowsky ... Washing Fibres ... 379
Babington ... Preventing Incrustation ... 379
Specification Due, but not Enrolled:—
Clyburn ... Wheel Carriages ... 379
Weekly List of Designs for Articles of Utility Registered ... 380
Weekly List of New English Patents ... 380

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MR. FAIRBAIRN'S PATENT TUBULAR CRANES.

Fig. 1.

Fig. 2.

Fig. 9.

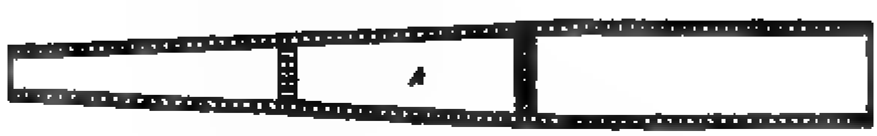
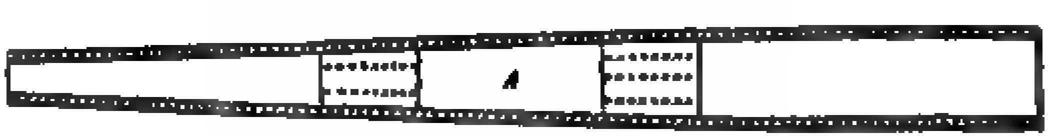


Fig. 8.



MR. FAIRBAIRN'S PATENT TUBULAR CRANES.

(Patent dated November 7, 1850. Specification enrolled May 7, 1851.)

Specification.

My improvements in cranes and other lifting and hoisting machines consist in constructing the jib of such machines of metal plates, so arranged and combined as to form a connected series of tubular or cellular compartments, instead of forming the jib of one solid piece, as heretofore.

Fig. 10.

Fig. 1 is a vertical section of a crane constructed according to my said invention, and calculated for lifting or hoisting weights up to about eight tons. Fig. 2 is an elevation of the same; figs. 3, 4, 5, and 6 are cross sections on the lines *ab*, *cd*, *ef*, *gh*; and fig. 7 a transverse vertical section on the line *ik*. A A is the jib, which, in its general outline, is of a crane-neck form, but rectangular in its cross section, as particularly shown in figs. 4, 5, and 6. The four sides are formed of metal plates firmly riveted together. Along the edges the connection of the plates is effected by means of pieces of angle iron. The connections of the plates at the cross joints on the convex or upper side of the jib are made by the riveting on of a plate which covers or overlaps the ends of the two plates to be joined; the rivets at this part are disposed as represented in fig. 8 (a plan of the top plates).

and known as "chain riveting." B B is the pillar, which is firmly secured by a base plate p to a stone foundation B^1, and fits at top into a cup-shaped bearing C^1, which is firmly secured to the side plates of the jib, at or near to the point where the curvature commences, and on which bearing the jib is free to revolve. Fig. 7 is a transverse vertical section of the lower part of the jib, showing the manner of fitting the bearings for the chain barrel (which is placed in the interior), and the spindles and shafts of the wheel gearing by which the power is applied thereto. D is the chain pulley, which is inserted in an aperture formed in the top of the jib. The chain passing over this pulley enters the interior of the crane, and is continued down to the chain barrel. E is a pulley or roller, which is interposed about halfway between the chain pulley and the chain barrel, for the purpose of preventing the chain rubbing against the plates. Fig. 9 is a plan of the lower plates.

Fig. 10 is a vertical section of another crane constructed upon the same principle as that which has just been described, but calculated for lifting much greater weights (say twenty tons); it differs in having the lower or concave side A A of the jib strengthened by means of three additional plates B, B, B, whereby the interior is divided into one large and three smaller cells, as shown in figs. 11 and 12, which are cross sections upon the lines *ab* and *cd* of fig. 10. This arrangement of the cells to strengthen the lower or concave side is advisable, in order to obtain sufficient resistance to the compression exerted by the load lifted, without unnecessarily increasing the weight of the other parts. The tension exerted upon the upper or convex plates does not require so much material to withstand it. C is the toe of the jib, which rests in a step formed in the bottom of the cylindrical casing D, which is built into the masonry forming the basis of the machine. E E are two of a set of pulleys, which are mounted between two rings F F, and serve as antifriction rollers for the upper bearing of the jib. The lowermost of the rings F F rests upon a set of rollers G G, which are fitted into the top of the casing D, so that as the jib is turned round, the rings F F, and the antifriction rollers which they carry, have perfect freedom to move along with it; H is a platform, upon which the persons working the machine may stand, and which supports a column I, within which there is mounted a spindle K, the lower end of which has keyed to it a pinion L, which gears into a circular rack M M, bolted to the top of the cylindrical casing D. N is a worm wheel keyed to the top of the spindle K, into which an endless screw, worked by a hand wheel, is geared, so that, by turning the hand wheel, the jib of the crane is made to move round in any required direction. O is the chain barrel; P the chain wheel; R R pulleys or rollers which support the chain, and prevent its rubbing against the plates of the jib.

In the cranes and hoisting machines which I have described, the chain barrels are inclosed within the jib, and the spindles of the wheel gearing are also inside; and this is the disposition of these parts which I prefer; but it will be obvious that they may be also placed outside of the jib in a manner similar to that generally followed in the construction of ordinary cranes.

And having now described my said invention, and in what manner the same is to be performed, I declare that what I claim is the constructing of cranes and other like lifting or hoisting machines, with jibs composed of a series of metal plates, arranged and combined so as to form a connected series of tubular or cellular compartments, as before exemplified and described.

LONDON FIRES IN 1850.—BY MR. W. BADDELEY, C.E., INVENTOR OF THE PORTABLE CANVASS CISTERNS; IMPROVED JET-SPREADERS; FARMER'S FIRE-ENGINE; EVERY MAN HIS OWN FIREMAN, ETC., ETC.

"The statistics of London fires are by no means devoid of interest, and the time may come when they will form an index to the social advancement of the people; for in proportion as houses are built more and more fire-proof, and habits of carefulness become more and more diffused, the number of destructive fires will assuredly lessen."—*Knight's London.*

There is little ground for charging the Fire-King with idleness during the past year, albeit the Metropolis has received less than an average share of his attentions. While London has been comparatively exempt from serious fires, the provinces have been the theatre of numerous conflagrations.

The number of fires in the Metropolis, at which the firemen attended, was in 1850, only 868; of these 267 were extinguished by the prompt exertions of the inmates; 389 were extinguished by the inmates with casual voluntary aid, while the suppression of 212 devolved upon the firemen. The total number of calls given at the stations was 1,038, as shown by the following Tabular statement:—

MONTHS.	Number of Fires.	Fatal Fires.	Lives Lost.	Chimneys on Fire.	False Alarms.
January	80	2	2	10	10
February	79	0	0	5	6
March	84	2	2	12	9
April	69	3	3	5	10
May	66	2	2	2	2
June	72	3	4	4	4
July	62	0	0	6	4
August	66	0	0	9	8
September	67	1	1	7	12
October	82	1	1	7	9
November	85	1	1	5	9
December	66	2	2	7	8
TOTAL	868	17	18	79	91

Instances in which insurances were known to have been effected upon the Building and Contents	381
Building only	141
Contents only	77
No Insurance	269
	868
Alarms from Chimneys on fire	79
False alarms	91
Making the total number of calls	1038

The number of fatal fires corresponds with that of the previous year, but the number of lives lost is very considerably less. These accidents may be classed as follows:—

Personal accidents from the ignition of wearing apparel	11
——— of bedding	2
——— smoking in bed	1
Suicide	1
Inability to escape from burning buildings *	3
	18

The number of lives saved by the Royal Society for the Protection of Life from Fire, has been 30

The following fires are deserving of particular notice, on account of their magnitude, or the peculiar circumstances by which they were attended.

Thursday, February 7, 1 A.M. Mr. Myers, builder, Pedlar's-acre, Lambeth. These premises were of great extent, and from the nature of their contents the flames spread with prodigious rapidity. The men of the West of England Company and Fire Brigade were sadly hampered for want of water, the mains of the Lambeth and Vauxhall Company affording no water for some time, and a very inadequate supply during the progress of the fire. The consequence was, that the whole of Mr. Myers's premises and the adjacent India rubber manufactory of Mr. Nickels, were entirely destroyed, and several large dwelling-houses in the York-road very severely damaged.

Thursday, March 7, 2½ A.M. Mr. Adam's, mast and block-maker, Commercial-road, Horseferry-road, Limehouse. These premises, which, with a valuable stock of timber, were completely destroyed, were supposed to have been wilfully fired by a man of the name of Ragan, for the sake of the trifling reward paid by the Fire Brigade to persons giving them intelligence of a fire. Ragan was tried for this offence (not his first) at the Central Criminal Court, found guilty, and sentenced to ten years transportation.

Friday, March 15, 7 A.M. Mr. Bremen, carpenter, 53, Theobald's-road. This fire commenced among a quantity of shavings in the lower part of the house, and the inmates were placed in great jeopardy. Two persons were rescued from the first-floor by Charles Goddard, No. 33 of the Fire Brigade; and Conductor Wood, who was promptly in attendance with the Royal Society's fire-escape, rescued two children that had been left to their fate in the top room, and were quite insensible when extricated.

Saturday, March 16, 7½ P.M. Messrs. J. and C. Rigby, builders and steam saw-mill, Holywell-

* One at Chiswick.

street, Westminster. These extensive premises were filled with an immense quantity of finished and unfinished work, timber, &c., among which the flames made rapid and fearful progress. The engines of the Brigade and West of England, with those of the parish, and Messrs. Thorne, the brewers, were soon in attendance, and the conflagration stayed in a manner that reflected the highest credit upon the parties engaged.

Wednesday, March 20, 1½ A.M. Messrs. Wakerbath and Collings, sugar-refiners, St. George-street East. These premises were both lofty and of great extent. The "old house" and the "single house" were destroyed, but by dint of great exertions, on the part of the Brigade and West of England firemen, the "double house" was saved.

Good Friday, March 29, 8½ A.M. The parish church of St. Anne, Limehouse, was discovered to be on fire, the origin of which was traced to a defective and over-heated flue, which first ignited the timbers of the roof, and before any effectual aid could reach the spot, involved the whole edifice in ruin; nothing but the outer walls remaining of this once beautiful structure.

Monday, April 8, 11½ P.M. Mr. Franah, No. 3, Bell-street, Paddington. This fire broke out in the ground-floor, and a report was spread that a boy was on the upper floor. A man named Ringsbury ascended to rescue him, but was himself overpowered. On the arrival of Conductor Clarke, with the Royal Society's fire-escape, he ascended, and although the smoke instantly extinguished his lamp, he entered the upper window and succeeded in bringing out the man Rainsbury, who was perfectly insensible, but speedily recovered. The boy had previously escaped.

Saturday, April 27, 5 A.M. Mr. Best, beershop-keeper, High-street, Shoreditch. This fire commenced in the first-floor, and placed the numerous inmates in imminent peril. Conductor Clements, with the Royal Society's fire-escape, was soon on the spot, and happily rescued eight persons; viz., Mr. Delaipre, his wife, and four children—George Brand, barman, and James Hall, potman. The prompt attendance and meritorious exertions of the conductor at this fire were highly extolled by the parties rescued, and by the numerous inhabitants who witnessed his heroic feat.

Sunday, April 28, 2¼ A.M. Mrs. Watts, victualler, the "Fountain," Foster-lane. The fire was discovered by a police-constable, who had great difficulty in arousing the inmates. Francis Baker, the waiter, rushed down stairs through the flames and was much burned, as was also Frederick Sutton, who followed him. Conductor Myers, with the Royal Society's fire-escape, was promptly in attendance, and ascended to the second-floor window, from which he rescued Mr. Sutton, the landlord, with his son and daughter, all severely scorched and nearly suffocated, the flames having reached the room.

Thursday, May 2, 3½ A.M. Mr. Butler, undertaker, No. 5, High-street, St. Giles's. The fire commenced in the lower part of the house, and cut off the escape of the inmates (Mr. and Mrs. Butler, their son and daughter), who got out of the attic window in their night-clothes, from whence they were soon extricated by Conductor Chapman, who was instantly on the spot with the Royal Society's fire-escape.

Friday, May 31, 3 A.M. Mr. Poulter, cheesemonger, Acton-place, Bagnigge-wells Road. This was confined to the shop and parlour by the prompt attendance and meritorious exertions of the firemen, who applied to the churchwardens for the Parliamentary rewards of 30s., 20s., and 10s. for the three first engines. The parochial authorities, however, only awarded them 7s. 6d. for the first engine and 5s. each for the two others,* which the firemen considering unjust and insufficient, they appealed to the Magistrate at Clerkenwell Police Court; when Mr. Arnold said that no class of men were more useful to society than firemen, and those who exerted themselves in the event of fire. Such persons ran great risk of their lives to save the property and lives of others, and parishes ought not to exhibit a niggardly meanness in rewarding them. He could come to no other conclusion but that the firemen were entitled to the rewards pursuant to the Building Act. The full rewards were accordingly paid.

Monday, June 17, 2 A.M. Mr. Jones, lodging-house keeper, No. 12, Phœnix-street, St. Giles's. This fire began in the front room ground-floor, and when discovered had made great progress, spreading consternation among the numerous inmates, several of whom succeeded in effecting their escape. Mrs. Harding, who occupied an upper room, precipitated herself into the back yard, and was killed on the spot. Margaret Molun, aged 14, in attempting to reach the attic window, was overtaken by the smoke and suffocated. Considerable delay appears to have arisen in sending for the fire-escapes and engines; and at the inquest on the unfortunate sufferers, evidence was given that, had timely notice been given at the fire-escape stations, it was probable the child at least might have been saved.

Monday, June 24, 9½ P.M. Mr. Birch, coffee-shop keeper, 110, Chancery-lane. This fire raged in the two upper floors, which were destroyed; and the adjoining buildings, which were very old, were placed in great danger. Conductors Robinson and Eyles, with the Royal Society's fire-escapes, were promptly in attendance, and the latter had the good fortune to rescue Mr. Connorton, the much-respected foreman of the West of England office, who had been overpowered by the smoke in one of the apartments which he had entered.

Friday, August 9, 2½ A.M. Mr. Udall, laceman, No. 107, Upper-street, Islington. The fire commenced in the lower part of the house, and the smoke cut off the retreat of the inmates, who appeared at the second-floor window imploring aid. This was soon afforded by Conductor Eyles, with the Royal Society's fire-escape, and he brought down in safety two males and six females; after which, in company with Mr. Brown, the Islington engineer, he descended through the smoke, discovered, and extinguished the fire.

Wednesday, December 11, 11 P.M. Mr. Butler, chandler and beer-shop keeper, Bennett-street, Chiswick. Mr. Butler, having succeeded in extricating his wife and children from the burning building, re-entered the premises, in which he perished. Mr. Butler's house, a double one, was entirely destroyed, and four others severely damaged, principally owing to the absence of water.

Monday, September 16, 11 A.M. Mr. J. Clitheroe, firework-maker, Weaver-street, Bethnal-green. Mr. Clitheroe and a man named Wheeler were the only parties in the premises when, from some unascertained cause, a terrific explosion took place, involving the neighbourhood in the utmost consternation, and carrying destruction in all directions. The inmates happily effected their escape with but little injury.

Thursday, September 19, 4½ A.M. Messrs. Allnutt and Co., wine-merchants, No. 50, Mark-lane. This was "the fire" of the year, and, when discovered, had attained so great a head that it was not possible to tell in what part of the premises it originated. The engines of the Brigade, West of England, and Customs, were soon in attendance in such numbers that the supply of water was wholly inadequate to the demand; and notwithstanding the exertions of the firemen, which were most praiseworthy, the flames spread with fearful rapidity into the adjoining warehouses, which were of very large dimensions, and filled with many thousand pounds worth of merchandise; and although a large salvage was eventually recovered, most of the Insurance-offices were heavy losers by this fire.

* The illiberality of the parochial authorities of St. Pancras, in these matters, has long been notorious.

Thursday, November 12, 10 P.M. Mr. Richards, carpenter, No. 3, Somerset-street, Whitechapel. The fire having commenced in the shop, an elderly man, named Harris, in the upper part of the house was in great danger. Police-constable Barker 92 H, and two other persons entered the premises, to try to rescue the inmates; but all were overpowered by the smoke, and would have perished but for the timely arrival of Conductors Low and Wood, with the Royal Society's fire-escapes.

The Daily distribution of last year's Fires was as follows:—

Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.
98	143	129	133	125	129	111

Their distribution throughout the Day and Night has been in the following proportions:—

	First hour.	Second hour.	Third hour.	Fourth hour	Fifth hour.	Sixth hour.	Seventh hour.	Eighth hour.	Ninth hour.	Tenth hour.	Eleventh hour.	Twelfth hour.
A.M.	43	38	49	26	24	20	14	9	20	9	13	18
P.M.	30	31	32	29	28	48	49	54	79	87	69	49

The following List shows the occupancy of that portion of the premises in which the Fire originated; thereby illustrating the comparative liability to accident by fire of various trades, manufactures and private dwellings:—

Occupation.	Totally Destroyed.	Seriously Damaged.	Slightly Damaged.	Total.
Apothecaries (no laboratories)	..	3	3	6
Bakers	2	4	10	16
Barge and boat-builders	..	..	2	2
Bacon-dryers	..	1	5	6
Bath-keepers	..	..	1	1
Beer-shops	..	3	14	17
Blacking-makers	..	1	1	2
Booksellers, binders and stationers	..	6	6	12
Brokers, and dealers in old clothes	..	3	8	11
Builders	4	5	4	13
Butchers	..	1	3	4
Cabinet-makers	..	6	6	12
Cane-dyers	..	..	1	1
Carpenters, and workers in wood (not cabinet-makers)	1	15	16	32
Chandlers	1	6	11	18
Charcoal and coke, dealers in	..	1	1	2
Cheesemongers	..	1	3	4
Chemists, including laboratories	..	1	2	3
Chocolate-makers	..	..	1	1
Churches	1	1	3	5
Cigar-makers	..	..	1	1
Coal-merchants	..	1	2	3
Coach-makers	..	..	2	2
Coffee-roasters	..	..	2	2
Coffee-shops and chop-houses	..	1	4	5

Occupation.	Totally Destroyed.	Seriously Damaged.	Slightly Damaged.	Total.
Confectioners and pastry-cooks........	..	..	5	5
Coopers	1	..	1	2
Cork-cutters	..	1	..	1
Corn-chandlers	..	2	..	2
Curriers, and leather-dressers	2	1	2	5
Distillers	..	2	..	2
——— illicit	..	1	1	2
Drapers, woollen and linen, and mercers.	..	7	9	16
Druggists, wholesale	..	1	..	1
Dwellings, private	..	35	235	270
Dyers	..	..	2	2
Eating-houses......................	..	..	4	4
Emery-manufacturers................	..	..	1	1
Engineers, mechanical	..	3	..	3
Farms	..	1	2	3
Feather-merchants, and dressers	..	1	..	1
Firework-makers....................	1	4	..	5
Fish-curer	..	1	..	1
Founders	..	2	1	3
Furriers and skin-dyers	..	1	2	3
Gas-works	..	1	..	1
Glass-blowers......................	..	..	1	1
Grocers and tea-dealers	..	4	2	6
Hat-makers	..	4	1	5
Horse-hair merchants	..	..	1	1
Hospitals	..	1	1	2
Hotels and club-houses	..	2	7	9
Lamp-black makers..................	..	1	1	2
Laundresses	..	..	1	1
Leather, patent japanned-manufacturers.	..	2	..	2
Lime-wharf	..	1	..	1
Lodgings	...	11	78	89
Lucifer match-makers................	..	3	..	3
Manchester warehousemen	..	..	5	5
Marine-stores, dealers in	..	1	1	2
Mast and block-makers	..	1	..	1
Mattress-makers....................	..	1	..	1
Miliners and dress-makers............	..	1	3	4
Musical instrument-makers	..	1	1	2
Nurserymen........................	..	..	1	1
Oil and colourmen (not candle-makers)..	1	5	5	11
Painters, plumbers and glaziers........	..	2	1	3
Painted baise-makers	..	1	..	1
Paper-stainers......................	..	3	3	6
Parchment-makers	..	1	..	1
Pasteboard-makers	..	1	..	1
Pawnbrokers	..	..	1	1
Printers and engravers	..	3	6	9

Occupation.	Totally Destroyed.	Seriously Damaged.	Slightly Damaged.	Total
Printers, copperplate	..	1	..	1
——, muslin	..	1	1	2
Printer's ink-maker	..	1	..	1
Public buildings	..	..	1	1
—— exhibition (not theatre)	..	..	1	1
Rag-merchants	..	1	2	3
Railways	..	..	2	2
Rope-makers	..	..	1	1
Sack-maker	..	..	1	1
Sale shops and offices	1	11	23	35
Saw-mills	1	3	4	8
Schools, charity	..	..	2	2
Ships	..	4	1	5
—— steam	..	..	2	2
Ship-builders	..	1	2	3
—— chandlers	..	1	..	1
Silk-dressers	..	..	1	1
Stables	..	6	5	11
Starch-makers	..	1	..	1
Straw-bonnet makers	..	1	1	2
Soda-water and ginger-beer makers	..	2	..	2
Soot-merchants	..	..	2	2
Sugar-refiners	..	1	..	1
Tailors	..	3	3	6
Tallow-chandlers, melters and soap-boilers	..	2	3	5
Tarpaulin-makers	..	..	2	2
Theatres	..	..	4	4
Tinmen, braziers and smiths	..	..	7	7
Timber-merchants	..	..	1	1
Tobacco-manufacturers	..	1	..	1
Tobacconists	..	1	5	6
Toy-warehouses	..	..	2	2
Under repair, or building	..	1	3	4
Unoccupied	..	..	1	1
Upholsterers	..	3	3	6
Varnish-makers	..	..	2	2
Victuallers, licensed	1	4	22	27
Wadding-makers	..	..	2	2
Warehouses	..	..	1	1
Water-works	..	1	..	1
Weavers	..	1	..	1
——, willow	..	..	3	3
Wharfingers	..	1	..	1
Wine and spirit-merchants	1	1	6	8
Wine-coopers	..	1	..	1
Wool-staplers	..	..	1	1
Workhouses	..	..	1	1
TOTAL	18	229	621	868

The Causes of Fire have during the past year been of the usual character, and so far as could be satisfactorily ascertained may be stated as follows :—

Accidents unforeseen and for the most part unavoidable	7
Apparel ignited on the person	11
Candles, various accidents with	113
———, ignited bed-curtains	77
——————— window-curtains	57
Carelessness, instances of palpable	19
Charcoal fires	2
———— used suicidially	1
Children playing with fire	7
——————— lucifer-matches	6
Chloroform, manufacturing	1
Cinders put away unextinguished	17
Coke	1
Coffee-roasting	1
Coppers improperly set	3
Fire sparks	54
Fires kindled on hearths and other improper places	6
Fireworks, making	3
————, letting off	4
Flues, foul and ignited	31
——, blocked up	10
——, defective and overheated	47
——————, in next house	5
Friction of machinery	1
Fumigation, incautious	5
Furnaces and boilers, heat from	19
Fuzees exploded by falling	1
———————— by sun's heat	2
Gas, escape of, from defective fittings	37
———— from street mains	2
——, lighting of	5
——, left burning too high	13
——, fittings, repairing or altering of	4
——, cooking stove	1
Gunpowder, explosion of	2
Hearths, defective	2
Intoxication	9
Kiln, overheated	1
Lamps, oil	10
———, naphtha	8
Lightning	2
Lime, slacking	2
Linen, &c., airing or drying before fire	35
Lucifer-matches, making	1
——————, using	4
——————, ignited by cat	1
Naphtha, upset and ignited	1
Ovens, defective or overheated	6
Oil, boiling	2
Pitch and tar, boiling	5
Reading in bed	4
Sewing in bed	1
Smoking meat	1
——— meat	5
Shavings, loose, ignited	44
Spontaneous ignition of coals	1
—————————— lampblack	4
—————————— greasy rubbish	1
Spontaneous ignition of phospohrous	1
—————————— railway signal lights	2
—————————— shoddy	1
Stills, illicit	2
Stoves, defective and overheated	11
———, improperly set	6
———, drying	9
———, pipe	14
———, ironing	1
Tallow melting	1
Tobacco-smoking	23
Varnish-boiling	2
Suspicious	7
Wilful	17
Unknown	47
Total	868

During the year 1850, numerous extensive conflagrations have occurred in various parts of England, by which the seats of several noblemen and gentlemen have been destroyed, as well as valuable manufactories and extensive farms laid in ashes. Among the last year's provincial fires, that which broke out at Gravesend, a little before two o'clock in the morning of Sunday, August 11th, stands conspicuous. The flames commenced in a double house in High-street, and though discovered early, made such rapid progress that the tardy efforts made to suppress it were wholly inefficient, and by three o'clock the light of the fire was visible in all parts of the metropolis. Many of the London engines proceeded some distance estward in search of the conflagration, but being unable to ascertain its whereabouts, they returned to their respective stations. At half-past six o'clock a message by the electric telegraph announced the fire to be at Gravesend, that a large number of houses were already destroyed, and the town in imminent danger. Firemen and engines were immediately dispatched per railway. On reaching Gravesend the firemen found a great part of the High-street in flames, and their utmost exertions needed to prevent the extension of the fire. Engines from Tilbury Fort, with those belonging to the town, the Customs, the Kent, and Sun Fire-offices, together with those from London, were brought to bear upon the parts where the danger was most threatening: and by midday the fire had done its worst, twenty-seven buildings having been burned down, and many more seriously damaged. When this town was the scene of former conflagrations, no recompense was awarded to a number of deserving, hard-working men, who were for several hours engaged in assisting to extin-

guish the fire; the consequence was, that at the commencement of the present conflagration, while it was quite within the means of the little fire-establishment of this pitiful place, no assistance was obtainable, and the fire for some time raged uncontrolled—Gravesend reaping a fearful harvest of *pound foolishness* for the *penny wisdom* they had previously sown.

The subject of fire-extinction has of late attracted a good deal of attention, having been considered by the Government as part and parcel of an extensive system of sanatory reform. The evidence collected by the Board of Health with reference to improvements in the water-supply of the metropolis for sanatory purposes, as well as for extinguishing fire, has been published; and it is probable that some practical measure for this object will be shortly brought before Parliament. It is pretty generally admitted that, to a "continuous water supply under considerable pressure," we must come at last; the experience acquired in the numerous places where this system has been adopted, being quite conclusive as to its efficiency. In the "Report of the General Board of Health on the Supply of Water to the Metropolis," the Commissioners observe, that "the inadequacy of the supplies of water under the intermittent system occasions great danger to life and property; but that, by arrangements which are practicable, under a system of constant supply at high-pressure, the whole force of the water in the mains may be brought to bear at any point for extinguishing fires in from one to five minutes, or in about one-fourth the time that it takes the best appointed fire-engines now to gain the spot and be in action after the alarm of fire has been given. That, judging from the experiences of various places where improved arrangements have been put in practice, it appears that by the general adoption of these arrangements, more than two-thirds of the fires which now occur in the metropolis may be extinguished before any extensive damage takes place. That the crime of incendiarism may be checked, and that these consequences alone, were there no other advantages to be obtained, would render it worth while to make the change from the intermittent to the constant system." Elsewhere the Commissioners observe, that "if persons in the rural districts wish to protect their property from fire, they may do so far more effectually by a *garden engine*, or any instrument in frequent use, than by a *fire*-engine reserved for extraordinary occasions." The readers of the *Mechanics' Magazine* need hardly be reminded how strenuously I have, *for years*, upheld this doctrine; and it is no small gratification to witness the steady and progressive development of plans so thoroughly in accordance with my views and opinions. In Mr. Braidwood's work on Fire-engines (1830), he disapproved of the use of *small* engines. "Much," he observes, "has been said about the convenience of conveying them up-stairs, and into places where the fire is raging; but I fear that those who have so strongly recommended them, have seldom made the experiment." In 1850, however, Mr. Braidwood had become so complete a convert to the opposite opinion, that we find him constantly and extensively using (with great success) the *smallest* of fire-engines, described at page 290 of your 52nd volume. In consequence of the favourable opinions now held with reference to portable engines, I have been induced to *register* a contrivance of that kind, which I had some time before constructed for the purpose of covering a *large burning surface* with a *small quantity of water*.

The accompanying engraving exhibits this engine, which I have designated "Every Man his Own Fireman." It consists (like Reed's, and many others) of a pump barrel within an outer casing, which forms the air-vessel. The principle peculiarity is in the arrangement of the valves and strainer. The valves are of gutta percha, and are both in the same plane, having the area of the outer tube or air-vessel apportioned between them, so as to afford the freest possible water sway. These engines are equipped with ten feet of vulcanized India-rubber hose (any additional length being affixable at pleasure), a branch-pipe, and jet-spreader.

This engine being held in a pail, tub, bucket, or other supply of water, and the handle worked up and down, a powerful jet of water will be projected to a distance of 40 feet, at the rate of eight or nine gallons per minute — thus enabling a continuous stream of water to be directed wherever a fire may be burning, without exposing the operator to any personal danger or inconvenience. Or, in case of fire in workshops, abounding in wood and shavings—in stables filled with hay and straw—and in bed-rooms, where flames may be revelling amidst curtains and draperies, the jet-spreader may be most advantageously employed. By merely pressing the thumb upon a small lever, the jet of water is instantly divided, and scattered in the form of a heavy shower, which drenches the whole extent of burning surface, and effectually extinguishes the fire. By means of this apparatus a very small quantity of water becomes really available for extinguishing a very large burning surface, while the damage done by water is the smallest possible. With the JET-SPREADER applied, a single pail of water becomes more effectual for extinguishing fire than a much larger quantity thrown wastefully from buckets, or even applied in the form of a jet, for *no fire can live under the action of the spreader.*

As a garden engine this apparatus is unrivalled; the spreader (which never chokes) enables the water to be thrown over the trees and shrubs in a genial shower, washing off the insects, &c., without injury to the plants.

It was a point with the Metropolitan Sanitary Commission, "That it would be a great advantage if the apparatus to be used in case of fire, were otherwise in constant use, so as to be kept in good order, and in a state of readiness, with the still further advantage of persons being familiarised with the use of it."

That the present system of fire-extinction in the metropolis is a costly and highly wasteful system both of water, labour, and time, is notorious to all (except, perhaps, those who have been brought up in the practice of it), and its days are numbered.

In his last report to the managers of the London Fire Establishment, Mr. Braidwood says, "I regret to state that the old watermen, who were principally depended upon for working the *floating engines*, are fast wearing out, and instead of them we are obliged in a great measure to employ the people who occasionally work at the dock and warhouses for threepence an hour, and who do not appear to possess either the strength or spirit necessary to work the engines efficiently, which may perhaps be attributable to the low diet on which they must exist." Had proof been wanting of the correctness of Mr. Braidwood's statement, it was abundantly furnished a few weeks after the foregoing was penned, at the burning of Alderman Humphrey's warehouses in Tooley-street, where the deficiency of "strength" and "spirit" was too plainly visible. Steam alone can render these unwieldy machines of any real use; and when the enormous cost of labour is considered, there can be little doubt that steam will prove to be the most economical as well as the most efficient power for this purpose.

At the latter end of 1850 the London Fire Establishment had two additional engines built, the one by Mr. Tilley, the other by Mr. Merryweather, under Mr. Braidwood's immediate direction and superintendence, and when completed they were tried at the old shot-factory, Commercial-road, Lambeth. The suction pipes of the engines were laid into the Thames, and the branch pipes affixed to a strong frame perpendicularly within the tower. A detachment of the Fusilier Guards was employed to work the engines. The branch pipes were afterwards tried outside the shot tower, the engine built by Mr. Merryweather having a decided advantage throughout; with forty feet of leather hose attached, and a seven-eighth nose pipe, the extreme height reached was said to have been, with Mr. Merryweather's engine, 130 feet, and with Mr. Tilley's engine 117 feet. In testing the quantity of water delivered by each, it was stated that with Mr. Merryweather's engine making 118 strokes (in three minutes), 297 gallons of water were delivered; that of Mr. Tilley's engine making 156 strokes in the same time, delivered 288 gallons. The barrels were 7 inches diameter, with 7¾ inch stroke, and these performances can hardly be surpassed, with the contracted suction-way which Mr. Braidwood prefers to retain,*

* Carefully-conducted experiments have shown, that as soon as the working speed exceeds 75 or 80 strokes per minute, the insufficiency of the suction-way becomes apparent, entailing a loss in the quantity of water delivered of from 3 to 5 per cent. and upwards.

in order to preserve uniformity in all the connecting screws.

THE LONDON FIRE ESTABLISHMENT, under Mr. Superintendent Braidwood, has quite equalled, if not excelled the performances of former years. Messrs. Fogo, Colf, Staples, and Henderson, the foremen, in their respective districts, have most zealously discharged their duties, and in conjunction with the men and officers under them, have shown a steady desire to consult the interests of their employers.

THE WEST OF ENGLAND firemen, under Mr. Connorton, preserve their conspicuous position; this office being particularly fortunate in their servants in the metropolis and elsewhere. The following testimonial to their good conduct in Liverpool was recently advertised.

"To Mr. Whitehouse, Agent to the West of England Fire-office, Liverpool.

"Sir,—I beg to return you my sincere thanks for the promptitude and energy displayed by the West of England Fire Brigade on the occasion of the fire in my premises on Sunday afternoon last, which but for the application of their portable fire-engine (Baddeley's) would have extended much farther than it did; and also for the celerity in which my second demand for assistance was responded to by Superintendent Barrett, when the rafters in the chimney were again found to be on fire.

I think your fire-office deserves the extensive support of the inhabitants of this town, for the liberal and effective services which your brigade gives to the public on all occasions, the more so as I find you make no charge for the assistance you render. "I am, Sir, yours, &c.,

"J. TATE."

The Directors of the West of England fire-office have also been much commended for the spirited manner in which they prosecuted a Mr. Foot, grocer, of Exeter, who was convicted of firing his premises, No. 6, Queen-street, and transported, upon evidence collected by the superintendent, Mr. Blake, and Messrs. Cornish and Whitehead, surveyors, of the West of England office.

THE ROYAL SOCIETY FOR THE PROTECTION OF LIFE FROM FIRE, through the instrumentality of their Conductors and fire-escapes, have been the means of saving *thirty* lives during the past year, as already stated. This fact shows, in a most striking manner, the necessity that exists for an efficient fire-escape provision throughout London, *without any intervening unprotected districts.* It is much to be regretted, both on account of the injury done to the Society and the satisfaction thus witheld from its subscribers, that the preservation of lives by the Society's fire-escapes are so seldom noticed by the public press. Only let a life be *lost*, and to-day we read a harrowing narrative of the catastrophe, to be again repeated on the morrow in reporting the "Coroner's Inquest." But if a life is *saved*, it rarely obtains a passing notice!

Thus perhaps but few persons, comparatively speaking, beyond the immediate vicinity in which the fires have occurred, have any idea of the extent of public service occasionally rendered by the Society; *few*, for example, are aware, that only the last week in April three fires occurred in the course of five nights, at which no less than fifteen persons were rescued by means of the fire-escapes of the respective districts, viz.,

At the fire at 210, Shoreditch, Saturday morning, April 27, when the Bishopsgate-street fire-escape Conductor rescued eight persons, viz., Thomas Delapré, his wife, and four children; James Hall, and George Brand.

At the fire at the Fountain Inn, Foster-lane, Sunday morning, April 28, when the Newgate-street fire-escape Conductor rescued three persons, viz., William Sutton, Frederick Sutton, and Mary Sutton. And

At the fire at 5, High-street, St. Giles's, Tuesday morning, April 30, when the Hart-street fire-escape Conductor rescued four persons from the roof, viz., Mr. Butler, his wife, son, and daughter.

It is only necessary to add that each of them *occurred within the hours of two and five*, A.M., that the persons rescued were all as aroused from their beds, scarcely having time to put on an additional garment, and that the liveliest gratitude has been expressed for the service the Society has been instrumental in rendering them.

THE PENDULUM EXPERIMENT.—TORSION OF THE WIRE.—OERSTED'S EXPERIMENTS ON FALLING BODIES. BY PROFESSOR YOUNG.

Sir,—I shall commence the present communication with a few words in reply to "S. Y." That gentleman remarks, in reference to my first paper, that "we may imagine the graduated table, over which the pendulum vibrates, fixed to the imaginary cone, and we shall see at once that the table can have no motion except *with* the cone, and that a line drawn from the apex of the cone through the centre of the surface of the table, will point to the apex of the cone during the whole twenty-four hours." All this is very true; and I hope "S. Y." *does* see it clearly, for then I am sure he will see something more. Let us suppose that this motion of the table and cone has continued—say for one hour; and that the movement then stops for the purpose of giving "S. Y." and myself a fair opportunity of examining what has actually taken place. The first thing that would strike us both would be that

our horizontal line P′N (I refer to the diagram in my last letter, p. 373,) had changed its direction; since the two directions meet and form an angle at N, we should see, too, that this change of direction arose entirely from one end of the line P′ travelling *faster* than the other end—faster, in fact, than any other point between P′ and N. Now, while thus watching the progress of the point P′, suppose some object, immediately above that point, at the commencement of its motion, were to follow its path, with a rate of motion however not equal to that of P′, but only equal to that of the *slower* point P; would this moving object ever come up with P′?—would not P′ get more and more in advance of it? Such a moving object, diverted, indeed, from its wonted course by the controlling string, is the bob of the pendulum; it pursues P′ as long as the rotation continues, but only with the slower rate of motion it had when hanging apparently at rest over the point P. This consideration will, I think, sufficiently convince "S. Y." that, at the end of our hour's examination, the meridian line on the table would form an angle *to the east* with the then path of the bob. If the earth rotate on its axis, this result is inevitable; and, conversely, if experiment prove the result to take place, the fact of the rotation of the earth follows as a necessary consequence.

There is one circumstance connected with Foucault's experiment, predicted by Liouville, and afterwards confirmed by observation, to which I have not yet alluded: the bob itself will turn round, its angular motion round its axis being equal, but in a contrary direction, to the angle of deviation of its oscillations. It is pretty generally thought, that from this circumstance, there must be torsion of the wire. I cannot assent to this opinion. I submit that the wire and bob turn round, not by the force of torsion, which appears to me not to be brought into operation at all, but only as every other object in connection with the earth turns round. If the bob were simply suspended over P, it would turn once round, continually presenting the same face to N, in one revolution of the earth, and there would be no twisting of the wire. Rotating in this way, the bob, when set oscillating, advances to P′; its original rotatory, as well as its original progressive motion, being still preserved. The latter motion, namely the revolution round the earth's axis, is proportional to, and may be measured by, the angle of deviation: the former motion, namely the rotation of the bob round its own axis, being performed in the same time, has the same angular measure; and, being in a contrary direction, the same face of it is always presented to the pole, or to the point N. I have now to remark, that the idea of the cone of latitude will subserve the purpose of accounting for a circumstance in the late M. Oersted's experiments on falling bodies, hitherto, I believe, involved in obscurity. I quote the following from the *Literary Gazette* of March 22, 1851:—"One of the most important observations first made by Oersted, and since then confirmed by others, was, that a body falling from a height, not only fell a little to the east of the true perpendicular—which is, no doubt, due to the earth's motion—but that it fell to the *south* of that line; the cause of this is at present unexplained. It is, no doubt, connected with some great phenomena of gravitation which yet remains to be discovered."*—*Lit. Gaz.*, March 22, 1851, p. 221.

The explanation of this phenomenon is very easy. Suppose a heavy body to be let fall from a point vertically over P (see diagram, p. 373): when it is let go, the body will have a progressive velocity towards the east *greater* than the velocity of P at the foot of the vertical; and this velocity it will preserve throughout its fall, which, from the nature of gravity, must be in *a vertical plane* through P and C, the centre of the earth. Now the point P, at the foot of the vertical line, *recedes* from this plane towards the *north* during the descent of the body, since it describes a circle oblique to it round the axis of the cone: the body, therefore, will fall towards the *south* of P as well as towards the east. If the experiment be performed in south latitude, the deviation will, of course, be *north* instead of south.

NOTE.—I find, upon further inquiry, that M. Chasles had *not* anticipated the idea of the cone of latitude, as I thought

* I regret that, from the loss of my library, I cannot now refer to the *Mecanique Celeste;* but I well remember that Laplace somewhere enters into a mathematical discussion of the phenomena: it is either in the first or second volume.

he had when I wrote my letter to this Journal of May 3.

I learn that the only thing noticed by M. Chasles, in common with myself, is the quicker motion of the point P′ over that of the bob when at the extremity of its arc of vibration. He illustrates this by a reference to the phenomenon of the trade winds, and applies the reasoning which accounts for that phenomenon to the present case. I have no doubt, however, that in future, the peculiarity of the trade winds will be explained by a reference to the now established laws of the pendulum, and not the motion of the pendulum inferred from the phenomenon of the trade winds.

I am, Sir, yours, &c.,
J. R. YOUNG.

London, May 12, 1851.

THE GREAT EXHIBITION, 1851.—NO. II.

We now proceed—taking the "Official Catalogue" for our guide—to fulfil our promise of taking notice of such articles in the Exhibition as are most remarkable for worth or novelty. It must be confessed, however, that as surely as the Exhibition itself is a great success, so surely is the Official Catalogue (so far as yet published) a great failure. There are two editions—a cheap one (one shilling), which gives merely the titles of the articles, and their numerical places in the sections to which they belong; and a dear—very dear one—called "Descriptive and Illustrated," but of which "Part I." (ten shillings and sixpence) only has yet made its appearance—including but four out of the thirty classes into which the contents of the Exhibition have been (pretended to be) arranged. Both are, for any purpose of guidance or reference, about equally useless. For though there is a vast display of systematic arrangement, there is in truth nothing of the sort. A classification has been adopted in the highest degree fantastical; and it has been just as fantastically carried out. If you want to trace out any article from the Catalogue, you find yourself in the situation of a person in the midst of a forest without a sign-post to guide him, or with sundry sign-posts, but all pointing some wrong way. For example; you wish to know where a certain "Colossal Statue of the Queen" is to be met with, and after long searching you find it under the head of "Mining and *Mineral Products*," because, forsooth, the material of which it is made belongs to the mineral kingdom. Or having heard of some capital barley raised by Prince Albert on his Windsor farm, if you turn for it to the list of "Substances used as *Food*," you stumble against peat-fuel, tobacco, snuff, whalebone, and Highland plaids! And so among "Chemical and Pharmaceutical Products," you find skins, furs, pallets, brushes, glass ventilators, candles, sea-weed, cod's liver oil, &c.; among "*Vegetable* and *Animal* Substances used in Manufactures," lead pencils, placard-holders, nitrate of lead, ultramarine, oxymuriate of tin, &c. The existence of such extreme incongruities shows that the pains taken to produce a correct classification can have been but small, and that the things must, in fact, have been thrown together very much at random. If, again, struck by some article in the Exhibition, you refer to the (small) Catalogue for information concerning it, you learn nothing more about it there, than is to be seen upon the label affixed to the article by the Exhibitor. Or if the article belong to any of the four classes embraced under Part I. of the "Descriptive and Illustrated," and you refer to that, in expectation of a flood of light being thrown upon it, you are treated to the glimmer of a farthing rushlight. Of the entire body of annotations contained in this Part, (though more than a score of double and triple "lettered" persons are stated to have been employed upon them), there are not a dozen worth quoting for either their novelty or instructiveness. Generally speaking, they are of the most common-place character imaginable; having more the air of encyclopædic compilation than of being derived from original sources. Two or three of the best of these we subjoin:

From His Grace the Duke of Buccleugh, Drumlanrig Castle.

Model of the furnaces and pots employed on the exhibitor's mines, at Wanlock Leadhills, in Dumfriesshire, for separating pure

silver by a process from the rich lead ore of that district.

[In all great smelting works of this class, the smoke rising from the furnaces is highly charged with most noxious vapours, containing, besides other poisonous matter, a large quantity of lead; many attempts have been made to obviate this nuisance, and the system adopted by the exhibitor has been found to be very successful.

An oblong building in solid masonry, about 30 feet in height, is divided by a partition wall into two chambers, having a tall chimney or tower adjoining, which communicates with one of the chambers at the bottom. The smoke from the various furnaces, eight in number, and about 100 yards distance from the condenser, is carried by separate flues into a large chamber, from thence by a larger flue it enters the first chamber of the condenser at the very bottom, and is forced upwards in a zigzag course towards the top, passing four times through a shower of water constantly percolating from a pierced reservoir at the summit of the tower. The smoke is again compelled to filter a fifth time, through a cube of coke some two feet square, through which a stream of water filters downwards, and which is confined to its proper limits by a vertical grating of wood.

The smoke having reached the top, is now opposite the passage, into the second, or vacuum chamber.

This is termed the exhausting chamber, and is about five feet by seven feet inside, and 30 or more feet in height.

On its summit is fixed a large reservoir, supplied by an ample stream of water, always maintaining a depth of 6 to 10 inches.

The bottom of this tank is of iron, having several openings or slots, 12 in number, about an inch in width, and extending across the whole area of the reservoir, communicating directly with the chamber beneath.

On this iron plate works a hydraulic slide-plate, with openings corresponding in one position with those in the reservoir.

This plate receives a horizontal reciprocating motion from a water-wheel or other power, driven by means of a connecting rod and crank.

In the middle of every stroke, the openings in the plate correspond with those in the bottom of the reservoir, and a powerful body of water falls as a shower bath, the whole height of the vacuum chamber, and in doing so, sweeps the entire inside area, carrying with it every particle of insoluble matter held suspended in the vapours coming from the furnaces.

The atmospheric pressure, of course, acts in alternate strokes as a blast at the furnace-mouths, and causes a draught sufficiently strong to force the impure vapours through the various channels in connection with the water, the wet coke and exhausting chamber, until it passes, purified and inert, into the open atmosphere.

The water, saturated with particles of lead, &c., held in mechanical solution, finally passes into great dykes or reservoirs excavated for the purpose; and then deposits at leisure its rich charge of metal.

The results of this constructure are most apparent and beneficial to the surrounding neighbourhood.

Formerly, the noxious fumes passing from the shafts of the furnaces, poisoned the neighbourhood; the heather was burnt up, vegetation destroyed, and no animal could graze, or bird feed near the spot.

Now, the green heather is seen in all its native luxuriance close around the establishment; and the sheep graze within a stone's throw of the chimney's base, and game on all sides take shelter.—J. A. L.]

Kurtz and Schmersahl, Cornbrook Works, Manchester—Manufacturers.

New colouring matters, and preparations for printing and dyeing in cotton, linen, silk, and wool.

Specimens of printing and dyeing by means of the preparations.

Ultramarine, in different qualities.

[Lapis lazuli is usually found in granite and crystalline limestone. The finely-coloured varieties are employed for vases, in mosaics and furniture, and are much prized. The pigment ultramarine is prepared from the mineral, by slightly igniting it, shaking the mass in water, and, after reducing it to fine powder, mixing it with a resinous paste. This paste is then kneaded in cold water, which washes out the ultramarine, the impurities being retained by the paste. From the costliness of ultramarine its use was formerly confined to the artist; since, however, the discovery by M. Grumet (guided by the analysis of the pigment by MM. Clement and Desormes), of a method of preparing it artificially, its price has become gradually so much reduced as to admit of its very general employment in the arts. For, although M. Grumet kept his process a secret, M. Gmelin and other chemists have published prescriptions for its production, and its manufacture has been of late years much extended, particularly in Germany, though only very recently introduced into England. Ultramarine is a very permanent colour under atmospheric influences, but is decolorized by the presence of acids with liberation of hydrosulphuric acid; hence, in its employment, the presence of acids should be avoided. Artificial ultramarine may be prepared, according to C. Gmelin, by rapidly igniting a mixture of equal parts of silica,

carbonate of soda, and sulphur, first adding a sufficient quantity of a solution of soda to dissolve the silica. The result is a bluish-green mass, which, by ignition in contact with air, becomes blue. Ultramarine consists essentially of silica, alumina, soda, and sulphur; a small quantity of iron appears to be beneficial, but an excess impairs the beauty of the colour—W. D. L. R.]

Russell and Robertson, Omoa Foundry, Holytown, Lanarkshire—Inventors.

Specimens of white-lead paint, or ceruse, yellow chromate of lead, and red dichromate of lead; manufactured by a new process, and solely in the humid way.

The usual mode of converting blue lead into white lead, by the action of acetic acid, occupies six weeks or two months, whereas by the new process the same end is attained in one day, without endangering the health of the workmen.

[White lead is the well-known pigment which, when ground in linseed-oil, is used in house-painting. It is a carbonate of lead, generally containing hydrated oxide of lead, which is sometimes combined in the proportion of one atom of hydrated oxide to two of carbonate of lead. The most useful method (the Dutch) of manufacturing white lead is likewise the oldest. It consists in exposing lead to the joint action of acetic acid vapour, moist air, and carbonic acid gas. The lead is cast in the form of stars or gratings, and supported a little above the bottom of earthern pots (in shape like garden-pots), into each of which a small quantity of weak acetic acid is placed. The pots are then built up in alternate layers, with spent tanner's bark, until a stack is formed; each layer of pots being covered with boards. The fermentation, which soon takes place in the tan, serves the double purpose of furnishing carbonic acid, and raising the temperature of the stack, which reaches 140° Fahr. After a lapse of six or eight weeks the metallic, or blue lead, as it is called, is converted into porcelain-like masses of white lead, which is levigated in water, washed, and dried. About 16,000 tons are annually made in England by this process. A very small quantity of acetic acid suffices for the conversion of a large amount of metallic into white lead; as, after it has combined with a portion of lead oxide to form neutral acetate of lead, this salt dissolves another atom of lead oxide, which is removed by the carbonic acid as carbonate of lead, and the neutral acetate set free, again to take up a fresh portion of newly-formed oxide of lead, produced by the action of the air on the metallic lead. Most of the new processes depend on similar reactions, with this difference, that oxide of lead (litharge) is employed instead of metallic lead; it is either made into a paste, with a small quantity of acetate of lead and water, or else dissolved either in a solution of neutral acetate, or neutral nitrate of lead, and submitted to the action of carbonic acid, produced by the combustion of coke or charcoal, which precipitates the dissolved litharge, leaving the acetate or nitrate at liberty to dissolve fresh portions. Another of the new plans consisted in precipitating a neutral salt of lead (the nitrate, for example) with an alkaline carbonate.—W. D. L. R.]

(To be continued.)

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 10, 1851.

RICHARD ARCHIBALD BROOMAN, of the firm of J. C. Robertson and Co., of 166, Fleet-street, Patent agents. (A communication.) *For improvements in railways.* Patent dated November 7, 1850.

These improvements consist in a method of joining the different lengths of rails end to end, whereby the upper surfaces with which the carriage wheels come in contact are at all times kept flush one with the other, and at one uniform level.

The drawings annexed to the specification show two U-shaped, or bridge rails as thus joined together. A coupling bar of wrought iron of the same form as the hollows on the under sides of the rails is inserted, and fits into these hollows with some degree of tightness, and the coupling bar is farther secured to the two rails by rivets at the ends; for which however, screw bolts, or keys, may be substituted if preferred. The rivet holes at one end are punched out of an oblong form, to allow for the expansion and contraction of the metal. One rail only is in the first instance riveted to the bar, and after this has been laid in its place, the rail is riveted up to it. The joint thus formed is perfectly stiff, both vertically and laterally; yet at the same time permits of a sufficiency of play for the expansion and contraction due to the difference of temperature.

Claim. — The connecting the different lengths of U-shaped rails end to end, by means of coupling bars of wrought iron and rivets, or bolts, as before described.

JAMES BLACK, of Edinburgh, machine-maker. *For a machine for folding.* (Partly communicated.) Patent dated November 7, 1850.

Claims.—1. A machine for folding paper, cloth, and other substances, in the general arrangement and disposition of the parts of which the same consists, that is to say, in so far as regards the employment of serrated-

folding blades, moving or oscillating upon a centre, so as to describe at each movement a portion of a circle, and that within a chamber, into which the material to be folded is pressed, and also the placing of these chambers, when more than one fold is effected, at, or as near as may be at right angles, each to the chamber immediately preceding it.

2. The serrating, or toothing of the blades of folding machines.

(We shall give a full description of this machine in an early number.)

JOHN ALEXANDER LEROW, of Boston, America, gentleman. *For certain improvements in sewing machines.* Patent dated November 7, 1850.

Claims.—1. Constructing the shuttle of a curved form with a pointed nose, and causing it to travel round an endless shuttle-race, whether of a circular or other suitable form.

2. The employment of a peculiar construction of cloth-carrier, and of a pad for maintaining the filling thread in its proper position; and the combination of a nipper or bent lever, of which it forms a part, for the purpose of preventing the cloth from rising with the needle after it has made a stitch, with the vibrating arm on which the needle is mounted.

3. The employment of springs with studs taking into recesses formed in the shuttle, and of a cam by which these springs are withdrawn from the recesses to enable the shuttle to pass between the needle and the thread carried by it, and the combination of these parts with the shuttle-race and main shaft.

WILLIAM CRANE WILKINS, of Long-acre, engineer. *For an invention for lighting, and in apparatus for lighthouses, signal, floating, and harbour lights.* Patent dated November 7, 1850.

Claims.—1. The application of cylindrical lenses or panels, and annular lenses or panels to the rotating drum of lighthouses. This arrangement is intended to supersede the employment of both fixed and rotating drums in the same lantern, as in the present arrangement for producing alternate glares and flashes. Mr. Wilkins employs one rotating drum only, which is composed of alternate panels of cylindrical lenses of the same description as the ordinary fixed drum, and annular lenses of a new construction, consisting of a central lens surrounded by a number of rings which aid in concentrating the light. The light, issuing through the cylindrical panels, extends over and includes a space of 45° (when eight panels are employed), and to the eye of an observer on a level with the lamp, this is succeeded by an interval of eclipse, until the rotation of the drum has brought round the annular lens, when a glare, extending over a space of 7½° will be produced by the concentration of the rays of light in the annular lens. This will be followed by another eclipse, caused by the rings of the annular lens, after which the cylindrical lens will again come into operation.

2. The application to the rotating drum of revolving lights of lenses, whereby the rays from the catadioptric parts are concentrated, so as to produce a glare or flash coincident with that caused by the annular lens. Also a method of supporting the drum on conical rollers and inclined surfaces in combination with adjusting screws for moving the rollers, and thereby raising or lowering the drum.

3. An arrangement of revolving light with a reciprocating motion.

4. The application of lenses to floating lights, in lieu of the ordinary parabolic reflectors.

5. The application of cylindrical lenses to ships' lanterns.

6. A peculiar construction of candle and candle-holder for lighthouse purposes in which the candle is made trilateral, and the holder provided with guide-rods to maintain it in a perpendicular position.

7. The application of a cylindrical lens or lenses to signal lanterns.

8. The application of an annular lens to signal lights.

ROBERT CLARE, jun., of Exchange-buildings, Liverpool, gentleman. *For improvements in the manufacture of metallic casks.* Patent dated November 7, 1850.

This invention, as claimed by the patentee, consists in making casks from staves made of sheet metal, the object being to render them conveniently portable when not required for use.

The staves are formed with the requisite bulge and taper to produce a cask of the desired form, and are provided with flanges at the edges for securing them to each other, which may be done by bolts and nuts or any other convenient method. The hoops may be made of wood or of iron, being provided in the latter case with a screw to tighten them. The heads of the casks may be formed of wood or metal, and retained in their places between knees of angle iron. When the casks are employed for containing fluids, it is recommended to introduce a slip of India rubber between the abutting flanges of the staves.

JOHN ROBINSON, of Stepney, engineer. *For improvements in lifting and moving fluids and other bodies, and in apparatus for steering ships and other vessels.* Patent dated November 7, 1850.

The improvements here claimed have relation,

1. To pumps and apparatus for raising and forcing water. The pump barrel and rod have each blades or portions of a screw attached to them, and revolve in opposite directions, by which means the water will be raised and delivered at the top of the barrel, which is provided with a fixed cap and exit pipe. The other arrangement, which is applicable for raising water from low to higher levels, is constructed on the same principle.

2. To the combination with apparatus for working pumps of a nipping lever, formerly patented by Mr. Robinson, and also to apparatus for working windlasses.

3. To several improvements in the construction and working of rudders. The rudder is composed of two parts, the upper one of which is hollow, and made of metal, so as to admit of the lower half being raised within it. In one arrangement for steering, the spindle of the wheel has a screw cut for it, and on this screw slides a nut, which is connected by a system of levers to the rudder-head. The turning of the wheel causes the nut to travel backwards and forwards, and consequently moves the rudder in either direction.

Samuel Edwards, James Ansell, and Patrick Heyns, of Shadwell, engineers *For certain improvements in obtaining and applying motive power, and also in pumps.* Patent dated November 7, 1850.

The patentees describe and claim—

1. Several forms of rotary and semi-rotary and trunk engines, which do not appear to possess any striking features of novelty.

2. The application of a peculiar construction of three-way cock or tumbler used for admitting steam to the cylinders of these rotary engines as a substitute for the slide-valve in ordinary engines.

3. The application of engines on the above principles for pumping and forcing water.

Robert Lucas, of Furnival's-inn, mechanical draughtsman. *For improvements in telegraphic and printing apparatus.* (A communication.) Patent dated November 7, 1850.

This invention consists in a system of stereotyping with gutta percha, as applied to cylinder printing.

In the case of types, they are first set up and corrected as usual, and an impression taken with a warm sheet of gutta percha spread on fine but strong linen, and covered over with black lead. A second sheet is then placed at the back of the first, and both, when sufficiently cool, removed from the type, and again brushed over with black lead, to perform the part of the matrix. The gutta percha of which the printing surface is composed is prepared by immersing it in dilute nitric or nitrous cid till soft, then steeping it in water holding carbonate of soda in solution to neutralize the acid, and finally working it up as usual. A sheet of the thus prepared gutta percha is warmed, placed on the matrix, and submitted to gentle pressure, when a stereotype will be produced fit for use.

Claim.—The application of gutta percha, alone or in combination with other ingredients, to form the figured surfaces for printing cylinders, to transmit impressions in ink or other colouring matters used in printing on to paper and other fabrics.

The existence of the word "telegraphic" in the title of this patent, seems to have been ignored, for no allusion is made to telegraphic apparatus of any description whatever.

David Christie, of St. John's-place, Broughton, Salford. *For improvements in machinery or apparatus for preparing, carding, spinning, doubling, twisting, weaving, and knitting cotton, wool, and other fibrous substances; also for sewing and packing.* (A communication.) Patent dated November 7, 1850.

Mr. Christie describes and claims various combinations of machinery for effecting the different operations specified in the title of his patent.

George Frederick Morrell, of Fleet-street, gentleman. *For improvements in obtaining and applying motive power, and also in pumps.* Patent dated Nov. 7, 1850.

Mr. Morrell claims—

1. A peculiar construction of rotary engine, and also a vibratory engine.

2. The application of engines on this principle for raising and forcing water, and as hydraulic power engines.

Thomas Main, of the Strand, printer. *For improvements in printing machinery.* Patent dated November 8, 1850.

The machine described and claimed by Mr. Main is provided with a traversing table, which carries the form, and a reciprocating roller by which the impressions are obtained, both of which are driven from the same rotating shaft. The roller is mounted in bearings capable of rising and falling during the back traverse of the table, to prevent the roller from being inked when one traverse only is taken advantage of in printing. In order to obtain a register of the impressions on each side, the sheet, when fed into the machine, is held in position by projecting points, on which it is again placed when the second side is to be printed.

William Palmer, of Sutton-street, Clerkenwell, manufacturer. *For improvements in the manufacture of candles and night-lights.* Patent dated Nov. 9, 1805.

Claims.—1. The combining of resinous

matter in a state of powder, with tallow or other candle stuff, when manufacturing candles and night-lights with wicks which turn out of the flame when burning, as well as with straight-burning wicks.

2. The manufacture of spiral wicks for candles with stiffened strands gymped into them during the process of manufacture; and also cementing stiffened yarns, threads, or fibrous matter on to wicks for candles.

3. A method of saturating wicks with candle stuff: also the employment of two or more previously-saturated wicks that bend out from the flame when wires are used; also the employment of two, three, or more previously-saturated wicks that bend out from the flame when arranged on frames to be united and retained in position by candle stuff without the aid of wires.

4. Certain improvements in the means and apparatus used for spreading wicks.

Lucien Vidie, of Rue du Grand Chantier, Paris, French Advocate. *For improvements in measuring the pressure of air, steam, gas and liquids.* Patent dated Nov. 9, 1850.

Claims.—1. An arrangement for obtaining in pneumatic instruments already provided with an indicator band, more extensive divisions by the employment of two indicating hands.

2. Several arrangements in pneumatic instruments for setting the indicator hand at its proper point of division, and for adjusting the same.

3. An arrangement of jointed organs, or organs susceptible of extension for transmitting the motion from outside the box of pneumatic instruments to apparatus for setting the hand at the point of divisions.

4. An arrangement or arrangements for lengthening or shortening the arm of the lever in pneumatic instruments, provided with an indicator hand, for the purpose of regulating the length of their course.

5. An arrangement for regulating the action of pneumatic instruments, and also for varying the length of their course.

James Scott, of Falkirk, Shipwright. *For certain improvements in docks, slips and apparatus connected therewith.* Patent dated November 9, 1850.

Claims.—1. A mode of lifting vessels by direct application of hydrostatic power.

2. The application of vertical hydrostatic lifting cylinders for the elevation of vessels.

3. A method of transferring vessels from the lifting platforms or apparatus broadside off, or in a lateral direction.

4. The employment of shores or supports, hinged to their supporting surfaces, and with or without connecting chains.

5. A system or mode of traversing or moving ships' carriages by the use of hydrostatic pressure cylinders, acting against fixed rack teeth or studs, on the platform or ground.

5. The application of hydrostatic self-adjusting keel blocks, for receiving, supporting and elevating vessels.

7. A mode of receiving and supporting vessels by means of connected water-pressure cylinders or vessels.

8. A system of elevating or lowering ships on hydrostatic pressure cylinders, by the alternate forcing into and discharge of water from such cylinders.

9. Constructing and arranging the supporting arms for the carriages of slips, or ships elevating apparatus, wherein one end of such arm may be disconnected from the carriage, so as to admit of the arms being turned to lay longitudinally along the sides of the carriage.

10. The application of a double chock for the adjustment of the supporting arms of slips to suit the angles of the floor of different ships.

11. The employment of double steam-heated pans or pots, for heating or boiling pitch, or other material for shipwrights' use.

Sir Francis Charles Knowles, of Lovell, Berks, baronet. *For improvements in the manufacture of charcoal.* Patent dated November 9, 1850.

Claims.—1. A method of procuring charcoal from light and porous substances, such as waste tanners' bark compressed or air-dried, peat or turf, or other ligneous substances of small specific gravity.

2. The power of collecting the gases and volatile vapours arising from the dry distillation or decomposition of the raw material without the application of external heating or firing.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Harding Hallen, of Burslem, Stafford, manufacturer, for improvements in gas burners. May 10; six months.

Charles Morey, United States, America, gentleman, for improvements in machinery for preparing, dressing, cutting, and shaping stone, and other materials made use of for building purposes and architectural decorations. May 10; six months.

Emilian de Dunin, of Queen Charlotte-row, New-road, gentleman, for improvements in apparatus for measuring persons, and for facilitating the fitting of garments. May 4; six months.

Thomas Holmes and John Webster Hancock, of Melborne, Derby, manufacturers, Albert Thornton, of the same place, and James Thornton, of Leicester, mechanics, for improvements in the manufacture of knit and knit and looped fabrics, and for raising pile thereon. May 10; six months.

Edward Wilkins, of 60, Queen's-row, Walworth, Surrey, gentleman, for improvements in labels or tickets. May 13; six months.

Edward John Carpenter, of Toft Manks, Norfolk, Esq., captain in Her Majesty's navy, for improvements in the construction of ships and vessels, and in machinery or apparatus for propelling and directing the same. May 13; six months.

Luke Smith, of Littleborough, Lancaster, mechanic, Mark Smith, of the Sun Ironworks, Heywood, in the same county, power-loom maker, and

Matthew Smith, of Over Darwen, in the same county, for improvements in fabrics, in weaving, and in machinery and apparatus for winding, weaving, cutting, and printing. May 14; six months.

William Hemsley, of Melbourne, Derby, lace manufacturer, for improvements in the manufacture of looped fabrics. May 15; six months.

Robert Oxland and John Oxland, both of Plymouth, chemists, for improvements in the manufacture and refining of sugar. May 15; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
May 5	2806	E. Wolff and Son	Spitalfields	Artists' companion.
7	2807	G. Graham	Leeds	Wringing and mangling machine.
12	2808	N. Jones & A. McLenna	Liverpool	Tube plug for marine and other tubular boilers.
13	2809	W. Ladd	Walworth	Adjustments for microscopes.
,,	2810	T. Gowland	Leadenhall-street	Spring catch-fastener applicable to brooches.
,,	2811	L. White	Upper Ground-street,	Chimney stopper.
14	2812	I. Ireland	Manchester	Cupola.
,,	2813	Barret and Brothers	Oxford-street	Portmanteau.
15	2814	W. Kirkwood	Edinburgh	Watercloset.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

April 29	189	W. H. Molan	Cranbourne street	Tooth-brushes.
,,	190	J. Pirkins and Co.	Worcester	Gloves.
30	191	G. Myers	Lambeth	Window-sashes.
,,	192	H. Bigford	Wolverhampton	Slide lever-detector lock.
,,	193	I. Naylor	Yorkshire	Bobbin cop motion.
,,	194	E. F. Fourdrinier	Sunderland	Penholder.
May 1	195	J. L. Hancock	Goswell-road	Shower bath.
,,	196	F. De Porquet	Fenchurch-street	Hay and straw-cutting machine, with corn-cutting machine combined.
7	197	C. R. Oliffe	Ramsgate	Fraud-preventor.
,,	198	J. Farrell	Dublin	Window.
10	199	E. Faulkner	York-street	Accordion-stand.
,,	200	F. Fletcher	Gloucester	Apparatus for supplying fire-engines with water.
,,	201	W. D. Paine	Thomas-street, Blackfriars	Ventilator.
,,	202	W. Taylor	Birmingham	Banker's security inside shutter-bar.
,,	203	W. C. Rickman	Knightsbridge	Level.
,,	204	W. C. Rickman	Knightsbridge	Rod level.
,,	205	T. Cook	Plumpstead	Alarm for houses.
13	206	J. Bonallack	Church-lane, Whitechapel	Staves and stays for van and cart-bodies.
14	207	S. Howle	Aston, near Birmingham	Machine for cutting builders' laths.
,,	208	J. S. Cockings	Birmingham	Match-box.
,,	209	C. B. Lewis	Westminster	Equilibrator.
,,	210	M. Gibson	Newcastle-upon-Tyne	Clod-crusher.
,,	211	J. Lee	Bread-street Hill	Life-preserving and swimming vest.
,,	212	T. Wilkins and Son	Sheffield	Regulator spring screw.
,,	213	G. Darling	Perth	Ventilator for a hat.
15	214	E. Dent	Edgbaston, near Birmingham	Perforated rim flower-pot.
,,	215	T. Powell	Birmingham	Flexible union pen and holder.

CONTENTS OF THIS NUMBER.

Mr. Fairbairn's Patent Tubular Cranes—Specification—(*with engravings*) ... 381
Annual Report on London Fires in 1850. By Mr. Wm. Baddeley, C.E. ... 383
Mr. Baddeley's "Every Man his Own Fireman"—(*with engraving*) ... 391
The Pendulum Experiment—Torsion of the Wire—Oersted's Experiments on Falling Bodies. By Professor Young ... 392
The Great Exhibition, 1851.—No. II.:—
The Official Catalogue ... 394
Warloch's Lead-smelting Machinery ... 394
Artificial Ultramarine ... 395
Russell and Robertson's Patent White Lead ... 396
Specifications of English Patents Enrolled during the Week:—
Brooman ... Railways ... 396
Black ... Folding Machines ... 396
Leroy ... Sewing Machines ... 397
Wilkins ... Lighthouses ... 397
Clare ... Metallic Casks ... 397
Robinson ... Pumps, &c. ... 397
Edwards & others ... Pumps, &c. ... 398
Lucas ... Printing Apparatus ... 398
Christie ... Knitting, Sewing, &c. ... 398
Morrell ... Motive Power ... 398
Main ... Printing ... 398
Palmer ... Candles ... 398
Vidie ... Pneumatic Meters ... 399
Scott ... Docks ... 399
Knowles ... Charcoal ... 399
Weekly List of New English Patents ... 399
Weekly List of Designs for Articles of Utility Registered ... 400
Weekly List of Provisional Registrations ... 400

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1450.] SATURDAY, MAY 24, 1851. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. NAPIER AND SON'S PATENT LITHOGRAPHIC PRESS.

MESSRS. NAPIER AND SON'S PATENT LITHOGRAPHIC PRESS.

THE lithographic press in common use has long been regarded as a very inadequate machine. The amount of manual power required to work it, and the slow speed at which, under the most favourable circumstances copies can be produced, disables lithography in its competition with letter-press. A career of brilliant success has attended the efforts of scientific men towards speed and perfection in this latter branch of the art, and the present printing machines surpass the hand press somewhat in the same ratio, as does our express speed the jogtrot of our forefathers. The engravings prefixed will serve to illustrate Messrs. Napier and Son's improvements upon the lithographic press. The machine is arranged to be driven by steam power; has belts, "crossed" and "open," supposed to be in connection with the engine, and to run upon the pullies, A, B, C. The crank pulley, B, is fixed on the screw spindle, D, and the other two work loose, or "dead," on the same spindle; these bands with their striking forks, *a*, are arranged so as to be brought alternately upon the fixed pulley, B, and thus a reversing motion is given to the screw. The nut in which the screw works is fixed to a crosspiece E, which braces the side frames, FF, together at bottom, while the bar G performs the same office at top; the scraper-box, H, is sustained between these frames at bearings, I, and is so fitted as to work freely. To support the frames and scraper-box independent of the screw and maintain them in position, allowing freedom of action, the rollers, JJ, are provided, which run in the planed recesses, K, along the top of the main standards, L.

The machine is shown with its tympan down, ready for starting; this is effected by pressing lightly upon the lever, *b*, which raises a catch, and allows the weight M to descend in the direction of its present inclination, and act upon the connections with the striking forks, so as to bring one of the bands upon the fast pulley, B, and make the scraper and its frames move forward. The return is caused by the frame F coming in contact with a stop *c*, which, yielding, acts upon the striking forks by its bar *d*, upon which it may be adjusted to give the travel required. On the return being accomplished the machine stops itself by a striking action against stop *e*, the catch *b* falling in to prevent the weight descending to its full throw, and thus retaining the two bands upon the two dead pullies, A and C, while the machine is prepared for another impression.

The action of the scraper is peculiar and novel; it is balanced, so that its tendency is to remain slightly raised, but in its forward movement, and at the point desired, it is made to descend by a stop fixed upon the top of the main standard, L, into a position vertical, or nearly so, in which position it is retained by its own forward progress against strong abutments projecting from the frames, F; on the return it resumes its raised position and passes back without impediment. The scraper may be adjusted to give the pressure desired, or the table on which the stone is placed regulated by screws.

The advantages embodied in this machine will be at once recognized by those interested. The pulling down of the scraper, and the labour and inconvenience attendant upon that operation, are entirely superseded by the simple and effectual valve-like movement just explained, which forms the groundwork of this combination, although it will alike apply to the press work by hand, and is the most striking novelty in the machine.

D. NAPIER AND SON.

April 26, 1851.

ON IMPOSSIBLE EQUATIONS. BY ROBERT HARLEY, ESQ., MEMBER OF THE MANCHESTER PHILOSOPHICAL SOCIETY, ETC.

(Concluded from page 187.)

[*Note by Mr.* COCKLE.—About three months since I had the honour of receiving a note from Mr. Septimus Tebay, of Preston, in which, after a remark upon my own researches on the subject of Impossible Equations, there occurs the following passage:—

"Some five or six years ago I remember stumbling on the equation $\sqrt{x+1}+\sqrt{x-1}=0$. By endeavouring to solve it in the usual way we get $2=0$. But if we first multiply by $\sqrt{x-1}$, we get $x=1$. Or if we multiply by $\sqrt{x+1}$, we get $x=-1$. Of course neither value of x will satisfy the equation; and I concluded from its appearance that it could have no more existence than $2=0$."

I merely mention this for the purpose of showing the very general interest excited by the species of equations now under consideration. In the following conclusion of Mr. Harley's paper I have given between brackets [ ] references to my own discussions of the examples treated of. After the publication of the present communication, I shall forward to this Magazine a short discussion of another surd equation with which Mr. Harley has favoured me.

JAMES COCKLE."]

2, Pump-court, Temple, April 4, 1851.

8. It is also worthy of remark that one solution of the equation

$$Ax+\frac{AC\infty(-BD)}{AC+BD}\sqrt{Bx+C}=D,$$

is (11, 20), $x=\dfrac{1}{2A^2}(B+2AD-\sqrt{B^2+4ABD+4A^2C})$ .... (22.)

In like manner, one solution of the equation

$$x+\frac{2ac\infty(-b)}{2ac+b}\sqrt{2ax+b}=c,$$

is (3, 21), $x=a+c-\sqrt{a^2+2ac+b}$ .... (23.)

We shall now give a few particular examples of the general equations we have been discussing.

(1°.) Find the roots of the following equation and its congener:

$$x+\sqrt{5x+10}=8.$$

(Wood's Alg., Thirteenth Edition by Lund, Art. 202.) [And Mr. Cockle's remarks at pp. 135 and 410 of vol. xlvii., and p. 182, vol. xlviii., and p. 520, vol. l.]

This equation is of the form (a'). Comparing coefficients we have

$$a=\frac{5}{2},\ b=10,\ c=8;$$

$\therefore\ 2ac+b$ is positive; and consequently the given equation has one root: viz. (8),

$$x=a+c-\sqrt{a^2+2ac+b}=3.$$

The root of the congeneric equation

$$x-\sqrt{5x+10}=8,$$

$$\text{is (17), } x=a+c+\sqrt{a^2+ac+b}=18.$$

(2°.) Find the roots of the equation

$$3x+\sqrt{30x-71}=5.$$

(Wood's Alg., Art. 216, Sch.). [And Mr. Cockle's *Horæ Algebraicæ*, *Mech. Mag.*, vol. xlvii., p. 151 (see also p. 136) and vol. xlviii., p. 182.]

This equation is of the form (a). Comparing coefficients,

$$A=3,\ B=30,\ C=-71,\ D=5;\ AC+BD=-63,$$

a negative quantity; hence the equation is impossible,—in terms of n, its root is thus expressed (13),

$$x=\frac{1}{3}(5n^2+5+n\sqrt{25n^2-21}).$$

The congeneric equation

$$3x-\sqrt{30x-71}=5,$$

has two roots (20), viz.,

$$x = \frac{1}{2A^2}(B + 2AD \pm \sqrt{B^2 + 4ABD + 4A^2C}) = 4 \text{ and } 2\tfrac{1}{4}.$$

(3°.) "Given $2x + \sqrt{x-3} = 16$; to find x."

(Prof. Young's Alg., Fourth Edition, page 135, Example 21. [And Mr. Cockle's *Horæ Algebraicæ*, *Mech. Mag.*, vol. xlviii., p. 183.]

Here $A = 2$, $B = 1$, $C = -3$, and $D = 16$; $\therefore AC + BD = 10$, a positive quantity; and hence (11)

$$x = \frac{1}{2A^2}(B + 2AD - \sqrt{B^2 + 4ABD + 4A^2C}) = 7.$$

9. It is deserving of note that (11), (16) are the respective roots of (α), (β) when any one of the following conditions among the coefficients is fulfilled: viz.,—

When A, B, C, D are each positive,
When A, C are positive and B, D negative,
When B, D are positive and A, C negative, or
When A, B, C, D are each negative.

In like manner, (8); (17) are the respective roots of (β), (β') either
When a, b, c are each positive, or
When a, c are negative, and b is positive.

Again, (α) is always *rootless*, and (β) satisfied by (20), either
When A, B are positive and C, D negative, or
When C, D are positive, and A, B negative.

And (α') is always rootless, and (β') satisfied by (21), either
When a, is positive, and b, c are each negative, or
When c is positive, and a, b are negative.

Robert Harley,
Member of the Manchester Philosophical Society,
Mathematical Tutor, College, Taunton.

October 31, 1850.

Errata, in the preceding parts of this paper.

Page 67, line 21 from the bottom, for $a \infty \sqrt{a^2 + 2ac + b}$, read $a \infty \sqrt{a^2 + 2ac + b}$,

Page 186, line 10 from the top, for $2a = c - 2\sqrt{a^2 + 2ac + b}$, read $2a + c - 2\sqrt{a^2 + 2ac + b}$.

" Line 16 from the bottom,

$$\text{for } x = \frac{1}{2A^2}(Bn^2 + 2AD + n\sqrt{B^2n^2 + 4ABD + 4B^2C})$$

$$\text{read } x = \frac{1}{2A^2}(Bn^2 + 2AD + n\sqrt{B^2n^2 + 4ABD + 4A^2C}),$$

" Line 8 form the bottom, for the root of x given,

read $x = an^4 + c + n^2\sqrt{a^2 + 2ac + b}$.

R. H.

NAVAL ARCHITECTURE.*

A treatise on naval architecture in which the principles of science, so far as they are applicable to this art, should be laid down simply, intelligibly, and at the same time fully enabling the naval architect to comprehend something of the mechanical properties of those wondrous structures which his skill calls into being, has long been a deside-

* "The Theory and Practice of Shipbuilding. By Thomas White, Jun." London: John Johnstone, 26, Paternoster-row; 25, Princes'-street, Edinburgh. 1848.
"Treatise on Marine and Naval Architecture, or Theory and Practice blended in Shipbuilding. By John W. Griffiths, Marine and Naval Architect." Illustrated with more than Fifty Engravings. London: Putnam's American Agency. 1850. New York: Published by the Author.

ratum. To the keen sense of this want, felt not here only but across the Atlantic, we owe the appearance of the works which we now propose to pass under a short review. They are both the productions of practical men, whose own progress in this science has been much impeded by the small amount of information they have been able to derive from books; and having, as they conceive, fathomed the subject, they are anxious to impart the result of their investigations to other practical men who are desirous of following in their steps and of acquiring something more than a mechanical knowledge of their profession. The scientific part of Mr. White's book, which is discussed in thirty-one octavo pages, is little more than a criticism of some modes of construction employed by other builders, and especially by Sir W. Symonds, the late Surveyor of the Navy, who certainly cannot be accused of any undue partiality to science during his long reign at Somerset-house. The experience of Mr. White, who has for some years been a successful ship-builder, is undoubtedly entitled to much consideration and respect; but of scientific and theoretic knowledge applied to the art of architecture, we find no traces throughout his work. The chapters which he devotes to the laying off of ships on the mould-loft floor, we can recommend as giving simple, intelligible, and sufficient rules in a far more inviting form than any author has done who has treated on this subject that we are acquainted with. The miscellaneous chapter, except a few practical remarks, is of little value. Instead of giving the rudiments of algebra in the compass of five pages, or of geometry in three, the author would have done far better by referring his readers to sound elementary works on these subjects. The student of naval architecture must bring to his task a very considerable acquaintance with the more elementary parts of mathematics, including mechanics, and hydrostatics, if he wishes to acquire more than a very superficial knowledge of the principles on which his art is founded. Mr. White's treatise may be regarded as a very laudable attempt in a right direction; we should however have liked it better had he omitted altogether the word "theory" from his title-page.

Mr. Griffith's work is one of much higher pretensions than the English treatise we have just been discussing. The author deems it to be "in advance of the age in this complicated art," and to furnish just the link that was wanting to connect science and practice. As the author brings under review almost every question of any importance in naval architecture, we shall have an opportunity, as we proceed, of comparing his success with his anticipations. We will first say two words with respect to the *arrangement* and *style* of his work. The arrangement seems to us by no means happy. The author would have done well to have broken up his long paragraphs, and to have distinguished them by numbers, to enable the student to lay his hand at once on what he wants. As it is, the theory and practice are mixed together in so *confused* a heap, that it would be the work of very considerable time and labour to separate from it any information that might be desired.

Nor can we think the *style* such as becomes a grave, scientific publication. After the encomiums, however, which the work has received from a large portion of the American press, we hardly dare to express our real opinion of it, lest we should wound the vanity of our cousins across the Atlantic. We shall, therefore, give one or two extracts to enable our readers to form their own judgment.

In England, a chaste, simple, accurate style is generally acknowledged to be the best suited for conveying philosophical information: and, as a model of such composition, we may point to Sir John Herschel's "Treatise on Astronomy;" which, for simplicity, purity, and elegance of diction, accuracy of information, happiness of illustration, and lucid clearness of arrangement, is without a rival. We heartily commend this work as a model for imitation to Mr. Griffiths, and any one who may desire to present science to the world in a popular and pleasing garb. As

illustrations of the manner which Mr. Griffiths has preferred, we give, without comment, the following quotations from his first chapter:—

"Thus, the waves of oblivion cover the crumbling temple and its builder in the same solitary grave." "The fluctuous tide of time leaves only the mound between the furrows on its shores, to mark the spot where nations sleep." (Page 9.) "But our Creator has, in benevolence as in wisdom, adapted our mental constitutions to our moral responsibilities, and permitted us to *weave* the rainbow of anticipation on the dark rolling clouds that overshadow the past." (Page 10.) "Alas! for the commercial world! that the transcendent art should lie amid the *smouldering ruins of obscurity*; should be *mantled with the drapery of blood* for nearly fifteen hundred years!" We might multiply such quotations *ad libitum*, but we will content ourselves with one more: —"The *hoary head* of prejudice, mantled with a guise of experience, *dams* up the stream of knowledge, and *hurls defiance* at the man who dares to assert that the fields of science are open alike to all." Somewhat novel offices these for a "hoary head" —to dam up a stream and to hurl defiance!

It is not, however, our province to criticise the literary merits of Mr. Griffith's work—his philosophy, rather, is our game; and we should not have noticed his style but that it pervades not only his historical, but also his scientific statements, and often leaves us in considerable doubt what his meaning really is, as we shall have abundant opportunity of showing.

"Hereditary knowledge" comes in for a very considerable share of our author's *cutting remarks* and *pointed metaphors*: in fact, he seems scarcely able to restrain his mettle, so eager is he to do battle with this doughty giant whenever he comes across him. Some of his most transcendent flights of fancy are called forth by this fell enemy, whom he has a wonderful power of smelling out, however deeply hidden in the "musty folios of the past." Some of these flights, indeed, approach so near the sun (of truth?), are so much "in advance of the age," that, though our author's optics, like those of his country's bird, can bear the strong light, we find ourselves completely dazzled, and are obliged to give up the pursuit, as quite beyond our feeble powers, and descend as quickly as we can to the atmosphere of mere sublunary philosophy. We may misunderstand our author, for, as we have observed, his style is none of the clearest to us, but we cannot help conceiving that, in "hereditary knowledge," he includes the labours of European philosophers in the science of shipbuilding for the last two hundred years. If this be so, we must express our conviction that Mr. Griffiths abandons the only road that will conduct safely and unerringly to the Temple of Truth, viz., the method of induction. To deny the value of a great portion of the labours of such men as Euler, Bernoulli, D'Alembert, &c., in this science, were mere folly; and, indeed, our author does condescend to follow in the beaten track mapped out in their "musty folios" on the question of stability, although, as we shall see, he has not gained a very accurate perception of their ideas. There is, however, one extensive branch of science of vital importance to shipbuilding, which confessedly remains in a very unsatisfactory state. We mean the laws which regulate the resistance of fluids on solid bodies moving through them. We shall have occasion hereafter to recur to this subject. We shall only now mention, that any theory which has been adopted by scientific men on this important question, is confessedly only a makeshift until a more extended experience and satisfactory induction from it shall have placed these laws in a clearer light. The scientific world would hail with delight any well-seasoned efforts to remove the darkness in which this subject lies enveloped. Unsupported assertion, however, or rigorous abuse of the past, will hardly serve the turn. Careful and accurate experiments must be the basis of any theory which will satisfy European philosophers. We cannot help thinking, not merely from the general tenor of Mr. Griffiths' observations, but also from

the way in which he reproduces the established propositions, that he is not so well acquainted as might be desired, with the "knowledge" that comes in for so large a share of his indignation; and this it is not unnatural to expect. In a country like the United States, practical and therefore remunerative, rather than theoretical and *unremunerative* paths of life, absorb the greater part of the talent and energy of the country. Ships have to be built for commercial purposes as speedily as possible; and too much time has not hitherto been wasted in acquiring the principles of the science. An ingenious and observant builder will, however, perforce reason out many truths for himself; and fancying them discoveries, though they have been known in Europe for centuries, imagines that the whole secret of this complicated art lies within his grasp; and thus undervalues the contributions of preceding men of science, and as much overvalues his own knowledge, much of which is probably far from accurate. Such we believe to be the history of the work now under review.

Mr. Griffiths rightly considers that "a knowledge of the laws governing non-elastic fluids, and of solid bodies floating on fluids," is necessary to the scientific naval architect. "The state of fluidity," he tells us, "may be defined as that property in bodies which tends to form drops." Again; "Writers have attempted to give mechanical ideas of a fluid body; but the impossibility of giving any kind of *mechanical commination* must appear obvious if we but consider the circumstances necessary to constitute a fluid body." (May we respectfully ask the *meaning* of this sentence?) These circumstances our author states to be that the parts, notwithstanding any compression, may be moved in relation to each other with the smallest conceivable force; and secondly, that "the parts gravitate to each other, whereby they have a constant tendency to arrange themselves around a common centre, and assume a spherical form, which is easily executed in small bodies, *inasmuch as the parts do not resist motion: hence the appearance of drops always takes place when a fluid is in proper condition.* The dew-drop stands out in *drastic contrast* with solid bodies similarly circumstanced." "Solid bodies," we are told, "gravitate downwards, or toward the centre of the earth, while a fluid body may be divided or subdivided into the smallest conceivable molecules, and each particle will adjust itself round a common centre. This independent action of fluid bodies, denominated equilibrium, is a property which has perplexed not only the mass of mankind, but learned men in every age." "From what has been shown, it follows that the essential difference between fluids and solids consists in the *equilibriated gravity* of the former, or their equal pressure in all directions—upwards, downwards, obliquely, or laterally." Now who could obtain any idea of the distinctive characteristics of a fluid from these statements? If the author's words have any meaning at all, must we not necessarily draw from them this inference—that while solid bodies are attracted to the earth's centre, fluid bodies are attracted by each other, so as to arrange themselves in a globular form?—and while, therefore, solid bodies are subject to *gravity*, fluid bodies are subject to a different kind of force, which our author distinguishes by the very extraordinary name of *equilibriated gravity*. The real fact is, that both solids and fluids are equally under the influence of the earth's attraction, to which the name of gravity is given. The essential distinctive characteristic of a fluid we should, in common with those philosophers who have treated on this part of physics, designate to be the property it possesses of yielding in any direction to the action of a force, however small, so that its particles may be readily divided from one another. It is the result of experiment, although mechanical considerations also make it evident that fluids press equally in all directions; and hence pressures applied to a fluid are transmitted to every point of the fluid, and in this respect differ from the same pressures applied to a solid body, which, by experiment, are known to produce their full effect only *in the direction of the pressure itself*.

It is evident that a fluid, so long as it remains in equilibrium, *i. e.*, so long as

there is no motion of its particles relatively to one another, differs in its conditions of equilibrium in no respect from that of a solid body of the same density occupying the same space; for if any portion of the fluid were conceived to change its state without changing its density, and become solid, it is evident that hereby no new forces are introduced tending to separate the particles of the fluid that surround the solid portion: and it is from such considerations as these that the conditions of equilibrium of a rigid fluid are obtained—*deduced*, be it observed, from those of a rigid body. Hence it follows, that the pressure of a fluid at any point varies as the depth of the point below the surface of the fluidal rest; for if we conceive the point to be in the base of a very thin vertical prism of the fluid whose height is the depth of the point below the free surface, and then suppose this prism to become solid, *its density remaining the same*, it is evident that the vertical pressures on this prism are the pressure on the upper end, and its weight acting vertically downwards, and the pressure on the lower end or base acting vertically upwards; and from the conditions of equilibrium of a rigid body, we infer that this latter pressure must equal the two former. If, then, p be the pressure at the point whose depth below the free surface is h, and π the pressure at the surface, *i.e.*, the atmospheric pressure (about 15 lbs. to the square inch), g the accelerating force of gravity, and ρ the density of the fluid, and A the area of the base, we have πA = the pressure on the upper end, $g\rho hA$ the weight of the prism, and pA the pressure on the lower end.

$$\text{Therefore, } pA = g\rho hA + \pi A.$$
$$\text{or } p = g\rho h + \pi,$$
$$\text{or } p - \pi = g\rho h;$$

i.e. the difference of pressures at depth h, and at the surface is proportional to the depth, which is the more correct way of stating the proposition.

In the same way it may be shown *that the free surface of a small portion of a fluid under the action of gravity is a horizontal plane, and that the pressure is the same at all points in the same horizontal plane, within a fluid at rest under the same circumstances*, are results of the same characteristic property of fluids, and of the conditions of equilibrium of a rigid body. It follows from the same fundamental law that the pressure of a fluid against the surface of a solid immersed in it must, at each point of the surface, be exerted in the direction of the normal. It appears from some remarks that Mr. Griffiths makes further on in his book, that he is under the impression that European men of science are not aware of this fact, which only shows the very small degree of attention which he has paid to their reasonings, or his inability to follow them in their investigations. In fact, this is so fundamental a notion that it is not thought necessary to reiterate the statement at every turn; but we can assure our American cousins that it has not been reserved to the nineteenth century, or to a New York ship-builder, to make the discovery; and so far, at least, the book before our notice is *not* "in advance of the age." We should scarcely have thought that Mr. Griffiths seriously had this impression but for the remark which he makes on water lines in the draughts as usually planned, on the superior advantages of the *model* which it appears American builders always resort to. He objects to the name "water line" because it does not represent the line of direction in which the resultant fluid pressure acts. No one ever thought that it did represent any thing of the kind. But why should we not call by the name of water line, that line in the surface of the ship which coincides with the water's surface? And why should not lines parallel to this, be also denominated water lines if we so please? The only physical fact we represent by them is that the first is in, and the others parallel to, the water's surface; and that fact is undoubted. They play an important part in the calculations made from the ship's draught; and that is a very sufficient reason for giving them a prominent place and name among the useful lines on the draught. Our author would substitute for all these a line dependent on the form of the vessel, which we presume he considers a line along which the

resultant pressure of the fluid may truly be supposed to act. He does not condescend to tell us how this is obtained; but if, as we shrewdly suspect, it is a line at each point of which the resultant pressure on the corresponding transverse section of the vessel is supposed to act, we can only tell Mr. Griffiths that he is not more happy in representing a physical fact than he would have been by adhering to water lines. When a vessel is at rest, we know very well that the resultant pressure of the water upon it is equal to the vessel's weight, and acts upwards in a vertical line through the centre of gravity of the displacement. When the vessel is in motion the *magnitude*—not the *direction*—of the pressures on the several points of its surface is changed. To obtain the resultant pressure which alone will guide us to any tangible result, we must resolve the pressure on each element of the surface into three directions at right angles to one another, and thence by the principles of mechanics obtain the *resultant force* and *resultant couple*, to which all these several forces are equivalent. This is just the course which European men of science have pursued; but, unfortunately, their results are not much to be depended on; because the law, which has been usually assumed for the resistance of water to bodies passing through it; viz., that it varies as the *square of the normal velocity* has been proved to be incorrect except for angles of incidence greater than 50°. We have entered upon this discussion of fluid resistance sooner than we had intended; but we found it necessary in order to give our readers a notion of Mr. Griffiths' meaning, as far, that is, as we can gather it. It is evident that we learn nothing which can be turned to useful account by merely finding the resultant pressure on a series of contiguous sections, even though we do not commit the error of which we suspect our author has been guilty, of treating the fluid pressures on the several points as *parallel pressures*. However, the least we have a right to expect from a theorist who undertakes to set the world right on this important subject is to clearly explain his views.—(*To be continued.*)

THEORY OF THE ROTARY ENGINE.

Sir,—I beg to call your attention to an error in the subjoined extract from "Tredgold's Treatise on the Steam Engine." Edit. 1838.—In treating of the theory of the rotary engine, he says (page 359), that there is a loss of power equal in some cases to "nearly half the power of the steam used." This assertion is evidently founded on an imperfect view of the question, as in his attempt to prove it, he only considers the decrease in the effect of the power as it is applied nearer the centre of motion, overlooking the fact that the quantity of steam used is always in proportion to the effect of the pressure, as the formula he gives for ascertaining the loss of power will give the decrease of steam.

This remark, that the space the pressure acts through will be as the quantity of steam, is evidently not true of the point D, but of a mean between D and E, which will also be a mean of power; as much being gained in the effect of a power applicable at D, as is lost at E.

It is unnecessary to go through the whole formula; the piston acting simply as a lever, it is clear there can be no power lost or gained without losing or gaining an equivalent of motion. As an error of this kind, in a standard work, is calculated to mislead, perhaps you would notice it in your valuable Journal.

I am, &c., yours respectfully,

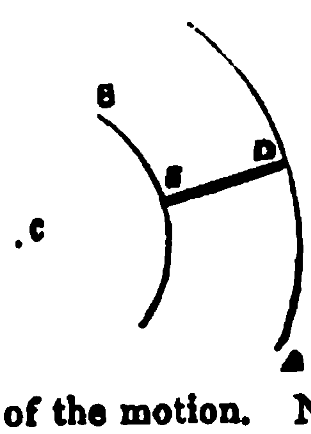
T. PATERSON.

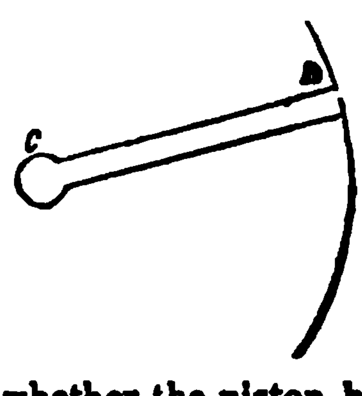
15, Rupert-street, Haymarket, April 24, 1851.

Extract from Tredgold.

"Conceive a piston, fig. 1, D B, fitted to a regularly-curved vessel A B, so that it may move round C, the centre of curvature of the vessel, and consequently the centre

Fig. 1. Fig. 2.





of the motion. Now whether the piston be moved by the force of high-pressure steam or otherwise, the pressure on an inch of area of the piston will be equal on all its parts, that is, the pressure on an inch at the most distant part, D, from the centre of motion is the same as the pressure on an

inch at the part E, nearest that centre; but since the piston is constrained to move in a circle, the effects of these equal pressures are as their distances from the centre of motion, and limited by the effect of the pressure at the most distant part, D. Hence, if the effective pressure of the steam be 10 lbs. on the inch, we have DC : EC :: 10 : $\frac{10 \times EC}{DC}$ the effect at E, that at D being 10. If the centre of curvature, C, were nearer the side of the vessel, the effect at E would be less. Therefore, the effect of pressure to produce motion is less than on a straight vessel having the same base; and if the bases be the same, the space the pressure acts through will be as the quantity of steam. Consequently, the quantities of steam being equal, the power of rotary action will be less than of rectilineal action. If a rectangular piston, DC, fig. 2, revolve round a centre C, then nearly half the power of the steam will be lost."

MARSDEN'S REGISTERED SYPHON FUNNEL

[Registered under the Act for the Protection of Articles of Utility. Charles Marsden, of Waterloo-house, Kingsland-road, Proprietor.]

The above engraving is a vertical section of this funnel. AA is a funnel similar to those in common use; B, a vulcanised India rubber ring or tube, which prevents the overflow of the liquid when the vessel into which it is poured is filled; B* is a syphon, which terminates in an upright vent-pipe C, fitted at the lower end with a valve D; E is a piston which fits the interior of the pipe C, and is only put in its place when required to be used.

In using this funnel, when the vessel is filled with liquid, the India rubber tube B, prevents it from escaping around the neck of the funnel, and if the surface of the fluid should be above the top of the syphon, the excess may be run off into a separate vessel by opening the valve D, while, if the surface of the fluid stands at a lower level than the top of the syphon, the piston E is drawn up by hand; which then fills the syphon, when the fluid is run off by the valve, as before explained.

PRACTICAL APPLICATIONS OF MAGNETO-ELECTRICITY — MR. SHEPARD'S (NOLLET'S) DISCOVERIES.

Ever since the discovery (1831) by Faraday of the induction of electricity by magnetism, that is to say that electric currents may be developed in a coil of wire or iron bar inclosed in a coil of wire, by the mere movement of magnets in close juxtaposition without contact, the efforts of ingenious men have been unceasing to turn this simple and apparently cheap source of power to practical account. Of these, one of the most notable and persevering has been Professor Page, of the Patent-office, Washington, to whom the American House of Representatives liberally voted, two or three years ago, a considerable sum of money, for the express purpose of having the problem satisfactorily solved; and down to a very recent period, the most sanguine hopes were entertained of the result of the professor's labours. According to accounts, however, received during the past month, Mr. Page has been no more successful than others. He has, indeed, made a locomotive engine to move by magneto-electricity, but *at so slow a rate* as to make the achievement valueless. Just as the American professor is retiring from the field (is beaten at least), another exeperimentalist has made his appearance on this side of the Atlantic, who, if we may credit the statement of a well-informed Belgian correspondent, has actually accomplished all that Professor Page has essayed in vain. We allude to M. Nollet of Brussels, whose discoveries have been patented here in

the name of Mr. W. E. Shepard. "To produce," says our Belgian correspondent, "the secondary current (the one by induction) was easy, but to prevent that current from weakening, and counteracting the primary current, there was the difficulty; and this it is which M. Nollet has overcome. By the means he has devised—which are amazingly simple—he has not merely prevented the secondary current from acting adversely, but caused it to harmonize with and very greatly augment the force of the primary one. The effects which he has thus obtained are quite surprising. Water he decomposes instantly, and obtains thereby hydrogen in any quantity which may be required, either for illuminating or for motive purposes, using in either case the auxiliary or supplementary means pointed out in his specification." The principal parts of that specification we have already published (see *ante*, p. 362), and beg to refer our readers to our abstract for a fuller exposition of the *sufficient reason* for the greater success claimed for M. Nollet.

STAITE'S ELECTRIC LIGHT.

(From the Manchester Courier.)

Public curiosity has been much excited to be made acquainted with the report of the Committee who were appointed so far back as August to inquire into the adaptation of this light for general illumination. The Committee having terminated their labours, the 9th instant was the first time the exhibition took place of the apparatus, constructed with a view of testing the self-sustaining power of the mechanical arrangement adapted for the continued development of the light, the sustaining power of the battery, and the cost of the whole. It was understood that the same experiments were gone through on this occasion as were required by the Committee, and parties in the room volunteered to keep accurate registers of the effects produced. The Company, among whom we recognized several members of the Committee, were invited for half-past three, shortly after which the battery was charged, and at four the light was set in action, it being understood that it was to burn for five hours and a quarter without interruption, that being the period at which the Committee had expressed themselves satisfied that it could be continued for any definite length of time. The Rev. St. Vincent Beechey of Worsley, took charge of the photometrical arrangement, by which the comparative power of the light was ascertained, and we observed Mr. Daniel Stone, jun., attending to the means adopted for measuring the electric power passing. The light continued to burn with increasing brilliancy from four o'clock to six, giving successively a light, adjudged equal, the first half hour, to 200 candles; at five, to 300; at half-past five to 400; and so successively till the electric fluid came into its fullest action at half-past six; when the light, by the instrument used,—which we heard had been borrowed for the purpose from Mr. Cleminshaw, of the gas-works,—developed the immense number of 700 candles; which intensity of light was steadily kept up till the experiment concluded at a quarter-past nine o'clock. By way of passing the time, and amusing the parties assembled, many of the experiments were given which had previously excited so much interest at the Town Hall; and it being perfectly light at the commencement of the experiment, and the sun shining, gave the opportunity of bringing coloured prints from the influence of the direct sunbeam to that of the ray from the electric light, in which not the slightest difference of shade of colour could be observed. The light of each was then passed through the prism, which still further established their identity, as their point of junction could not be ascertained,—thus proving its immense value to the manufacturer and exhibitor of goods. The light was then attempted to be diffused over the room by means of lens, generally used in French lighthouses, and known as the Fresnell-Lens, from the name of its inventor; but as the room was only some 120 feet long, and the Fresnell Lens is calculated to act on an area of a mile, no effect was produced beyond enabling us to imagine the possibility of so adapting it. The mode adopted by the English, by means of a parabolic reflector, which condenses the light in one direction, was then exhibited; and certainly the effect produced was sufficient to make us believe the statement, that at Sunderland the Commissioners were able to read at a distance of more than three miles at sea. The time having arrived at which the exhibition had been intended to close, before the company separated, a portion of the solutions produced by the action of the battery were drawn off and precipitated before the company present, and a white powder produced, which was represented to be a commercial value sufficient to pay the whole expense of producing the light or of that evening's amusement. Of course, in the absence of the Report of the Committee it would be impossible for us, merely attending in the capacity of spectators, to pledge ourselves for anything more

than we saw—we do not presume to be any judges of the value of these residues, nor to the precise amount of light developed, but it certainly is a most extraordinary amount of light; and the parties in the room—and we are not alluding to Mr. Staite, or any one apparently connected with him—stated with confidence the amount of candles to which it was equal; but if this light can be maintained for anything like a reasonable cost, its power of distinguishing colours by night as well as by day, and total absence of any heat, or contamination of air, renders it one of the most useful inventions on record.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 22, 1851.

James Rock, jun., of Hastings, coachbuilder. *For certain improvements in carriages, which are also applicable in whole or in part to other machines.* Patent dated November 9, 1850.

Claims.—1. Certain methods of varying the outline of carriages on the elbow line, by means of moveable fittings of various curvatures, as also the application to carriages, when their heads are removed, and they are intended to be used open, of elbow and door-pieces adapted for such change of use.

2. The construction of carriages with canopy-heads, having rolled up coverings.

3. A method of making the entire hinder part of a carriage head moveable, in combination with a folding-front roof, and auxiliary arrangements for the disposal of the glasses; as also a method of removing the roof by itself, and the quarters and backs by themselves.

4. The use of a spring, or spring perch, to enable a carriage to turn or lock instead of, or in combination with the ordinary centre pin or perch bolt.

5. Certain improvements in the steps of carriages.

6. A method of opening the door or doors, and letting down the step or steps of carriages by means of levers worked from the driving seat.

7. The making of springs for carriages out of flat plates of steel or other suitable metal, with a central rib of varying thickness or width; as also the filling (in some cases) of the concavity corresponding to the said rib with gutta percha or other soft substance.

8. Certain improvements in omnibuses, or other like public conveyances.

9. Various contrivances for removing and lifting off, or replacing moveable or shifting carriage heads.

10. Certain contrivances for enabling invalids or infirm persons to enter carriages.

Peter Spence, of Pendleton, Manchester, manufacturing chemist. *For improvements in the manufacture of alum and certain alkaline salts, and in the manufacture of cement, part of which improvements are applicable in obtaining volatile liquids.* Patent dated November 12, 1850.

Claims.—1. A method of acting on shales, schist, and other aluminous matters with sulphuric acid, at a regulated drying temperature, causing thereby the formation of sulphate of alumina, and rendering the matters acted on capable of yielding, by maceration in hot water, or heated mother liquors, clear solutions of sulphate of alumina of a strength sufficient for the production of alum by crystallization, and without evaporation.

2. Distilling ammonia into the acid mother liquids of the alum processes, and using such mother liquors in a heated state for digesting shales and washing out sulphate of alumina.

3. Distilling ammoniacal gas liquors by an arrangement of two or more boilers so contrived that the liquor under operation may be passed from one to the other throughout the entire range, and also passing a current of steam charged with the products of distillation throughout the entire range of boilers from the opposite end.

4. The employment of the spent shales from alum-manufacturing processes, for the manufacture of cement and hydraulic mortar.

5. The employment of the lime used in the gas-purification process, for the purpose of making cement and hydraulic mortar.

6. The introduction into such mortar and cement of zinc or oxide of zinc.

7. The production of carbonate of soda and carbonate of potash by passing the hydrosulphurets of soda and potash through carbonic acid gas at an elevated temperature.

Charles Marsden, of Kingsland-road, engineer. *For improvements in scissors and thimbles.* Patent dated November 12, 1850.

1. Mr. Marsden's improvement in scissors consists in attaching to one of the shanks a guide which bears upon the surface of the other shank in such manner that the pressure exerted upon that shank causes the two cutting edges to be kept in constant contact during the entire progress of the cut, by which arrangement the scissors cut to the very point without any danger of the article cut falling in between the blades and being ragged at the edges. Or instead of the guide being fitted to the side of one shank and passing over the other, it may be fitted

to the centre of one shank, and pass through a slot provided for the purpose in the other shank.

2. The improvements in thimbles have two objects; first, to obviate the discomfort attending the use of thimbles of the usual form, in which no provision is made for the escape of perspiration from the finger of the user, but which Mr. Marsden accomplishes by making them ventilating, *i.e.* with an inner perforated case; and, second, to guard the fingers from being pricked by the needle or cut by the thread when sewing or knitting, an evil for which the finger-guard here offered, which consists of an India rubber band and metal shield, will be found an effectual remedy.

Claims.—1. The constructing of scissors and shears, so that they may be enabled to cut by either the right or left hand with equal facility, and so also that their cutting edges are kept in constant contact during the progress of the cut, as above described.

2. The constructing of ventilating thimbles, that is with an inner case, between which and the outer case a space is provided for the escape of perspiration.

3. The construction of thimbles for protecting the fingers from being pricked or cut by the needle or thread in sewing or knitting.

Henry Wimshurst, of Limehouse, Shipbuilder. *For improvements in steam engines in propelling, and in the construction of ships and vessels.* Patent dated November 12, 1850.

Claims.—1. A peculiar construction of rotary engine.

2. Combining with a rotary engine, constructed on this principle, a separate cylinder or engine, to work the air-pump.

3. A method of raising and lowering the propeller of screw vessels.

4. A method of altering the angles of the blades of bow steering apparatuses.

5. The constructing of vessels with apertures in the bows, for the reception of thwart ship propellers or steering apparatuses.

6. A peculiar construction of apparatus, whereby the propeller pressure may be indicated, the engine and propeller shaft disconnected, and the engine moved round when the steam is not up.

(We shall take an early opportunity of giving the details of this invention.)

John Ball, of Ashford, Kent, Engineer. *For improvements in applying heat to bakers' ovens and their appendages.* Patent dated November 12, 1850.

Claim.—So arranging the flues of an oven that the flame and heated gases after passing against the crown and sides may be conducted under the oven, so as to heat that part of it, and then be applied to the heating of a "proving oven," or other appendage of the bakehouse.

Henry Medhurst, Engineer, in the employment of Messrs. Shears and Son, of Bankside, Southwark. *For improvements in gas meters.* Patent dated November 12, 1850.

The improvements here claimed comprehend—

1. The application to dry-gas meters of conical seated valves, with suitable passages for the introduction and discharge of gas into and from the meter; the valves (with the exception of their faces), and the apparatus for actuating them being so arranged as to be kept from contact with the gas, thus preventing corrosion and ensuring greater durability and facility of inspection and repair when needful.

2. The introduction in wet meters of a suitably-formed case with a small hole therein near the bottom, for the float to rise and fall in, the effect of which is to prevent the float and valve from falling too rapidly under the sudden pressure produced by the introduction of gas into the meter, and thereby obviate the disadvantage of a wavering or unsteady light, which not unfrequently results in wet-gas meters of ordinary construction under similar circumstances.

George Robins Booth, of London, Engineer. *For improvements in the manufacture of gas.* Patent dated Nov. 12, 1850.

Mr. Booth proposes to enable consumers of gas to supply themselves by means of an apparatus (which he claims, as also the mode of operating with it), in which it may be obtained from oleaginous, tarry or bituminous substances. This apparatus consists mainly of a cylindrical metal casing, in which is a fire-place lined with clay and coke, and having a muffle over it, above which is suspended by its neck a retort terminating at bottom in the form of an inverted truncated cone, the inclined sides having steps or corrugations to receive oil to be operated on, which is supplied by one or more feed-pipes when the retort is of a cherry red heat. The gas generated passes off through a pipe and intermediate chamber to a vessel containing coke or pumice-stone for the purpose of purifying it for use. The oil which condenses in the intermediate chamber is re-run into the retort through a pipe provided for the purpose, and again distilled together with the carbonaceous residuum of the preceding operation. Should the soot be allowed to accumulate after each operation, an air-hole must be provided to the retort for the purpose of burning it out.

Joseph Nye, of Mill-pond Wharf, Park-

road, Old Kent-road. *For improvements in hydraulic machinery, parts of which improvements are applicable to steam engines and machinery for driving piles.* Patent dated November 12, 1850.

The improvements here claimed comprehend a valve-box for double-acting pumps, and also the application thereto, as well as to steam engines (employed for driving propellers of that description which are moved backwards and forwards by a rod), and to pile-driving machinery (between the "monkey" and the moving power), of a system of crossed levers (lazy tongs), by means of which a long stroke of the beam may be obtained from a comparatively short one of the piston of the steam engine employed to drive such machinery.

Etienne Masson, of Place St. Michel, Paris, gardener. *For improvements in the preparation of certain vegetable alimentary substances, for the provisioning of ships and armies, and other purposes where the said substances are required to be preserved.* Patent dated November 12, 1850.

The object of this invention is the preservation of vegetables, fruits and some kinds of seeds, which are gathered in a green, moist, or succulent condition, in contradistinction to those which, like wheat, &c., are first allowed to ripen and dry. The process is applicable to cabbages, cauliflowers, spinach, sorrel, carrots, turnips, potatoes, apples, pears, cucumbers, melons, beans and peas, and many others, and consists generally in drying the articles by a gentle heat, and subjecting them to pressure so as to consolidate them previous to their being packed in cases for the sake of rendering them more conveniently portable. Modifications will of course require to be made in the treatment of different vegetables, fruits, &c.

Claims.—1. The combined process or processes of drying and forcibly compressing such substances, for the purpose of preserving them.

2. The preparation of the stalks of cabbages and similar vegetables, by drying them, and grinding them to powder or flour.

3. The preparation of peas and beans by the combined processes of immersion in boiling water and subsequent desiccation.

Edwin Clark, of Palace, New-road, Middlesex, Civil Engineer, and Henry Mapple, of Child's-hill, Hampstead. *For improvements in electric telegraphs and in apparatus connected therewith.* Patent dated November 12, 1850.

The first part of this invention consists in a method of preventing the deposition of moisture on the earthenware glass or pottery ware insulators employed in suspending telegraphic wires, by applying a band or inverted cup of metal, so as to preserve a dry zone of atmosphere around the body of the insulator.

The second part comprehends a method of applying currents of induction to the deflection of the index-hand of needle telegraphs, by attaching to one pole of the axis on which the needle is mounted, a cross bar of soft metal (iron or nickel), and placing a permanent magnet in such a position with respect to the cross bar, as to cause the oscillation thereof, and consequent deflection of the needle, when and according to the direction in which a current is sent through a coil surrounding the axis.

Claims.—1. The employment of metal in combination with earthenware, glass or pottery ware insulators.

2. Combining means of rendering metallic parts of apparatus temporarily magnetic, with suitable magnets for giving motion to such temporarily magnetized parts.

Edward David Ashe, of Brompton, Lieutenant, R.N. *For a new or improved nautical instrument or instruments, applicable especially amongst other purposes to those of great circle sailing.* Patent dated November 14, 1850.

The object of this instrument is to indicate to a vessel in great circle sailing (*i. e.*, when sailing on the arc of a great circle on the circumference of which are situated the points of departure and destination), the course to be steered either at the time of departure, or at any subsequent period of the voyage, and also to find the bearings of the sun or other heavenly bodies.

The instrument is not intended to supersede the necessity of taking an observation, but the exact position of the vessel being ascertained by this means, its use, as before observed, is to indicate the proper course to be steered.

William Duckworth, of Liverpool, coffee merchant. *For certain improvements in the manufacture of chicory, with certain improvements in the machinery or apparatus for the manufacture thereof.* Patent dated November 14, 1850.

Claims.—1. The preparing of chicory for grinding by a combination of roasting and steaming processes, together with the machinery or apparatus employed for that purpose in the peculiar arrangement, disposition and combination of parts of which the same consists.

2. Certain improved machinery or apparatus for roasting chicory.

3. The forming, moulding or compressing of chicory into pieces of the shape of berries and other arbitrary forms, and the use of figured rollers for that purpose.

Robert Howarth, of Chapman-street, Oldham-road, Manchester. *For improvements in machinery for raising a nap on cotton, woollen, silk and other fabrics.* Patent dated November 14, 1850.

Mr. Howarth describes and claims a method of combining the holding rollers, and the roller by which the nap is raised, so as to revolve in contact, and thus allow the raising roller to act only on so much of the cloth as may be at that time passing between the said rollers. The holding roller has its surface suitably provided with points, to prevent the cloth from slipping whilst under operation.

Joseph Conrad Baron Liebhaber, of Paris. *For improvements in blasting rocks; also in working marble and stone, and in preparing products therefrom.* Patent dated November 14, 1850.

1. These improvements have relation to a method of blasting (described in the specification of a patent granted to the same gentleman, March, 1845), in which a hole was first bored in the rock to be blasted, and acid employed to produce a cavity of sufficient size to receive the charge, and consist in slight modifications in the apparatus employed for introducing the acid, and withdrawing the same and the material dissolved by it; which operation is effected by exhaustion, or by a syphon. The patentee employs pipes made of gutta percha as being less injuriously affected by acid than those made of metal. In order to ascertain the capacity of the hollow produced in the rock, the patentee recommends that it should be filled with a mixture of sawdust and gunpowder in the proportion of one-tenth of the latter, which may be afterwards removed by exploding it. The exact quantity of powder required for a charge will be thus readily ascertained.

2. To obtain a flat smooth surface to a slab of marble or stone, the slab is suspended over a vat of dilute muriatic acid, and almost in contact therewith. The capillary attraction which ensues reduces the inequalities of the stone, and by gradually weakening the solution, and thus lessening the intensity of its action, a smooth surface will eventually be produced. In order to produce a convex surface, suitable means must be provided for giving the marble while suspended an oscillating motion corresponding to the curve of the surface to be produced.

3. To recover the muriatic acid employed from the material dissolved by it, and to render it again fit for use, it is placed in a close chamber, and carbonic acid gas generated by sulphuric acid and carbonate of lime, in sufficient quantity to expel the muriatic acid in a pure state through a filtering bed of sand or other material. Another resulting product of this operation is sulphate of lime, which is to be collected and purified for use.

Charles Allemand, of Paris, gentleman. *For an improved apparatus for obtaining light.* Patent dated November 14, 1850.

This apparatus resolves itself into a holder for burning wax-candles, tipped with phosphorous, and so arranged as to be ignited successively by the action of a scraper attached to the lid of the apparatus.

Claims.—1. The combination and arrangement of apparatus described.

2. The method of constructing and separating the candle-holder.

3. Raising the candle by a rack and pinion.

John Swindells, of the firm of Swindells and Williams, of Manchester, and Juce, near Wigan, manufacturing chemists. *For certain improvements in obtaining products from ores and other matters containing metals, and in the preparation and application of several such products for the purpose of bleaching, printing, dyeing, and colour-making.* Patent dated May 14, 1850.

1. To obtain copper and silver, or copper only, from their ores according to this invention, the ores are first roasted to drive off the sulphur and convert the metals to the state of oxides, after which the prepared ores are placed in tanks, and a solution of ammonia or its salts, of a strength of about 0·980, pumped on in sufficient quantity to saturate them. This solution is removed at the expiration of twelve to twenty-four hours, and will be found saturated with the metallic oxides, which are to be dissolved in boiling water and precipitated—the silver by hydrochloric, and the copper by hydrosulphuric acids or otherwise.

2. The ore from which zinc is obtained is the native sulphuret, which is mixed with about its own weight of common salt (for which muriate of potash, or of any earth, may be substituted), and exposed in a calcining furnace to a slow protracted heat until all the sulphur present is converted into sulphuric acid. The products of this operation will be sulphate of soda, muriate of zinc, and muriate of iron, which are to be dissolved out in boiling water, and the two latter precipitated by lime or other means after the sulphate of soda has been separated in the usual manner. The oxide of zinc, when thus precipitated, may be smelted in the ordinary way.

3. In treating chromium (chromate of iron), the ore is pulverized and mixed with

common salt, muriate of potash, or hydrate of lime, and exposed in a reverberatory furnace to a red or even a white heat, the mixture being stirred every ten or fifteen minutes, and steam at a very elevated temperature introduced during the operation until the desired effect is obtained, which may be ascertained by withdrawing a portion from the furnace and testing it, as customary. The products of this operation are finally treated in the manner usual for chromic and bichromic salts.

The mixture of chromium and common salt produces chromate of soda, the greater portion, or perhaps all of the iron contained in the chromium, being absorbed by the hydrochloric acid evolved from the salt, and carried off in the form of sesquichloride of iron. From the first mixture is manufactured pure bichromate of soda, which, by the addition of hydrochloric acid, may be converted to a chlorochromate; and from the last, or lime mixture, is produced a chromate of that earth, from which, by the addition of soda or potash, there may be obtained a compound salt, which, with those previously mentioned, may be advantageously employed in the operations specified in the title.

Claims.—1. The extraction of silver and copper from their ores by the use of a solution of ammonia, or a salt containing ammonia.

2. The method described of extracting zinc from native sulphuret of zinc by roasting with common salt, or a substance containing muriatic acid.

3. The process of forming chromic salts by operating on the ores, mixed with muriatic salts, subjected to the action of steam.

4. The application of pure bichromate of soda (instead of the bichromate of potash hitherto in use), for the purpose of producing colours, of raising vegetable or metallic colours, or of bleaching or discharging colours when so applied.

5. The use of chlorochromate of soda, of potash, and of lime, as new compounds, for producing and discharging colours.

6. The application of the compound salt of chromate of soda and lime and chromate of potash and lime to the above uses; it being more economical and better adapted for producing orange colour than any salt hitherto employed for that purpose.

Thomas Allan, of St. Andrew's-square, Edinburgh, printer and publisher of the *Caledonian Mercury*. *For certain improvements in electric telegraphs, and in the application of electric currents for deflecting magnets and producing electro-magnets.* Patent dated November 16, 1850.

Claims.—1. The dividing or arranging letters, words, and sentences into sections or divisions, so that each of the letters, words, or sentences so arranged, may be telegraphed or signalled by means of the number of the section or division to which it belongs, and the number or position of it in such section.

2. The constructing compound magnets, with their arms arranged in pairs of convenient shapes, for permitting the introduction of electro-dynamic coils or cylinders between them, each arm of every pair of arms of such a magnet having the same polarity, so that the attracting and repelling forces of the arms of the magnet, acting in conjunction with the electro-dynamic coils, may together deflect, turn, or move the magnet, and thereby the needle or other apparatus connected with its axle or spindle, in the required direction, according to the direction of the electric current through the coils.

3. The constructing of such compound magnets with their arms arranged in pairs of convenient shapes for permitting the introduction of the ends or poles of electro-magnets between them—each arm of every pair of arms of a compound magnet having different polarities, so that the attracting and repelling forces of the arms of the compound magnet, acting in conjunction with the attracting and repelling forces of the ends or poles of the electro-magnets may together deflect, turn, or move the compound magnet, and thereby the needle or other apparatus connected with its axle or spindle in the required direction, according to the polarities of the ends or poles of the electro-magnets.

4. The constructing of such compound magnets with their arms formed or arranged into convenient shapes for acting in conjunction with hollow electric coils, for the purpose of deflecting, turning, or giving motion to such magnets, and thereby to the needles or other apparatus connected with their axles or spindles.

5. The combining of notched, insulated, circular discs, so as to form a revolving compound disc, for the purpose of making, breaking, and reversing the electric circuit of a telegraph.

6. A mode of constructing a break or pole-changer for forming, breaking, and repeating or reversing the electric circuit of a telegraph.

7. A mode or modes of constructing a slotted frame apparatus, or instrument having buttons or pieces of metal placed along the sides of such slots for the purposes of making, breaking and reforming, or reversing the electric circuit of a telegraph, or

varying the continuance of the electric current.

8. An instrument with semiglobular nozzles to be used in conjunction with the slotted frame or apparatus, for the purpose of making, breaking and reforming, or reversing the electric current.

9. The constructing of an apparatus with two ratchet wheels mounted upon one axle or spindle, and two palls or clicks mounted upon an alternating frame for giving motion to the pointer of a circular dial or indicating telegraph.

ABRAHAM HALEY, of Frome, Somerset, machinist. *For certain improvements in looms for weaving.* Patent dated November 14, 1850.

Claims.—1. The application to looms for weaving textile fabrics of an arrangement of cams as a substitute for the crank movement for imparting motion to the slay beam, the cams being so formed as to produce two beats up of the slay to each shoot of weft thrown.

2. A method of deriving the picking motion for throwing the shuttles direct from the main driving shaft by means of a star or toothed wheel and tappets having an intermittent motion, and being connected by any convenient means with the ordinary picking levers.

3. The application to looms of weighted levers to counterbalance the harness and appendages, and to act as guides one lever to the other.

4. Making the slay beams, shuttle races, and shuttle-boxes of looms of cast iron, with grooves therein to receive the bottom bar of the reed.

5. A method of producing the movement of the slay by an arrangement of jointed bars and connecting-rods, so as to obtain a single or double beat-up of the reed upon the weft to each revolution of the crank-shaft, or complete traverse of the stay.

6. A method of producing the movement of the heddles or harness by grooved cams, pulleys, and wheels.

JOSEPH MARTIN, of Liverpool, rice-merchant. *For improvements in machinery and apparatus for cleansing and otherwise treating rice and certain other grains, seeds and farinaceous substances.* Patent dated November 16, 1850.

1. The apparatus claimed for washing, drying and calcining grain, seeds, flour, farina and starch, and for roasting coffee berries, consists of a cylinder composed of wire gauze, or sheet metal, with a worm or screw in the interior thereof, attached to an axis running the length of the cylinder, or to the interior of the cylinder itself, and revolving with, or independent of the cylinder.

2. The apparatus for cleansing rice, and which is also applicable for shelling peas, &c., is constructed on the principle of the ordinary mill; the substances being operated on by a runner, or serrated stone, or plate of metal revolving immediately below a fixed disc of wood faced with cork.

THOMAS COATS, of Ferguslie, Paisley, Renfrew, thread manufacturer. *For certain improvements in turning, cutting and shaping wood and other materials.* Patent dated November 16, 1850.

Claims.—1. A method or methods of working the tool beds of bobbing-turning machinery, so as to bring the cutter in contact with the block of wood, or other material in the proper time and position.

2. The adaptation of the sliding spindle to the purposes of pressing on the block and removing the finished bobbin from the arbour.

3. A method of feeding in or supplying the blocks to the arbour on which they are to be turned.

ALFRED VINCENT NEWTON, of Chancery-lane, mechanical draughtsman. *For an improved composition applicable to the coating of wood, metals, plaster, and other substances which are required to be preserved from decay, which composition may be also employed as pigment or paint.* (A communication.) Patent dated November 19, 1850.

The ingredients and their proportions employed in the production of this composition are as follows:—

Metallic zinc	14	parts by weight.
Metallic iron	1	,,
Oxide of zinc ..	369	,,
Oxide of iron....	273	,,
Silicic acid......	70	,,
Argil (?)	3	,,
Charcoal	47	,,
Carbonate of zinc	223	,,
	1,000	

The substances are to be reduced to fine powder, and ground up with two parts of linseed to one part of poppy oil, with sufficient quantity of spirits of turpentine to reduce them to the consistence of paint, which is to be applied in the ordinary manner, one coat being allowed to dry, before a second is laid on. When it is to be applied to walls, which are either very damp, or saturated with nitre, it is recommended to introduce from eight to ten per cent. of protosulphuret of antimony.

The following proportions have also been found by the inventor to answer well in practice:—

	First Extraordinary Coating.	First Ordinary Coating.	Second and Third Ordinary Coating.	Third Black Coating.	Third Light Coating.
Metallic Zinc	2	2	2	2	....
Metallic Iron	59	1	1	49	19
Oxide of Zinc	137	170	215	132	287
Peroxide of Iron........	77	218	202	103	409
Peroxide of Manganese ..	300	250	150	150	30
Silica	236	219	275	305	231
Alumina	30	29	31	26	23
Charcoal	159	111	124	233	1
	1,000	1,000	1,000	1,000	1,000

These ingredients are to be reduced to powder and mixed with oil and turpentine in the same manner as the composition previously described. When found necessary to plaster the wall with cement, so as to produce a level surface to receive the paint or composition, a cement composed of the following ingredients mixed to a proper consistence with three parts of linseed to one part of hempseed oil is recommended :—

Carbonate of lime....	450	parts.
Silica	87	„
Charcoal	83	„
Metallic iron........	47	„
Alumina	20	„
Metallic zinc........	1	„
Oxide of zinc	37	„
Peroxide of iron	25	„
Peroxide of manganese	250	„
	1000	

The wall is plastered with this cement to the depth, if necessary, of one-third of an inch, and may then be coated with either of the above-named compositions, or with ordinary paint.

Claims.—1. The manufacture of the composition above described, and of any modification thereof and its application as a pigment.

2. The use of silicic acid or silica, or a compound thereof as an essential ingredient in the manufacture of such composition.

3. The employment of protosulphuret of antimony in manner and for the purpose set forth.

Thomas Dunn, of Windsor-bridge Iron-works, Pendleton, near Manchester, engineer. *For improvements in machinery or apparatus for moving engines from one line of rails to another, and for turning them; also for compressing certain substances, and for raising and lowering heavy bodies.* Patent dated November 19, 1850.

Claims. — 1. Placing the intermediate wheels of traversing trucks in such positions that the peripheries of the wheels on the outside axles shall project beyond the peripheries of the wheels on the intermediate axles next in a line with them, so as to prevent shocks when passing flange gaps in the rails.

2. Attaching the inclined plane to traversing trucks by means of spiral or other folding joints.

3. A traversing truck with a shelving incline, constructed in such manner that a carriage placed thereon shall be supported by its wheel flanges, and so also that the truck itself may be lowered between the rails.

4. Combining with portions of the permanent way of rails suitable means for raising and lowering the same.

5. A traversing truck composed of horizontal plates of wrought iron, supported by large external and small internal wheels.

6. A peculiar construction of turn table.

7. A portable hand copying press.

8. A double-acting press placed horizontally, and for compressing cotton, &c., into bales.

9. Certain machinery for raising and lowering weights by the pressure of water.

10. A force pump with an oscillating barrel and valve clearer, and also a method of casehardening the interior of pump barrels at the time of casting, by combining with the core for moulding suitable materials, such as lime, salt, &c., by which this object may be effected, and thus dispensing with the necessity for boring out the interior of such pump barrels.

11. The application of hydraulic lifts for raising and lowering railway carriages.

12. The employment of a turbine wheel, worked by the water from the waterworks of towns, for raising and lowering weights and heavy bodies.

13. The application of water supplied from the waterworks of towns for raising and lowering safes containing papers and articles of value from and into the receptacle in which they may have been deposited.

JOHN HOSKING, of Islington, engineer. *For certain improvements in valves applicable to pumps, and also in apparatus to regulate the pressure and flow of water and air through pipes.* Patent dated November 19, 1850.

Claims.—1. A peculiar construction of valve, having numerous passages through rings in a direction radiating or diverging from the centre of the valve.

2. The application to valves generally of three or any suitable number of balls, as substitutes for clacks.

3. The application to apparatus for regulating and measuring the pressure of water and air on and through pipes, of a floating weighted air vessel, in combination with a valve of the peculiar construction above referred to.

WILLIAM HENRY RIPLEY, of Bradford, dyer. *For improvements in dressing and finishing piece goods.* Patent dated November 19, 1850.

The peculiar novelty of this invention consists in subjecting piece goods to the action of a frictional surface or surfaces, such as a hair-brush supplied with oleaginous or saponaceous material (by preference olive oil) in very minute quantities.

ROBERT BROWN, of Liverpool, plumber and brass founder. *For improvements in "the application of" pumps for raising and forcing water.* Patent dated November 19, 1850.

The words of the title included within the inverted commas have been disclaimed by the patentee.

The improvements claimed have relation to double-acting pumps, and consist in constructing them in such manner that water may be admitted to both cylinders at the lower side of the pistons by means of one valve, and discharged simultaneously from both cylinders by one valve above the pistons.

CLEMENT AUGUSTUS KURTZ, of Manchester, practical chemist. *For improvements in dyeing.* (A communication.) Patent dated November 19, 1850.

The improvements here claimed have relation to the dyeing or particolouring of hanks or skeins of silk, cotton, and other threads or yarns, and consist in tyeing in the hank to be dyed a series of slip knots, which are drawn tight, and the whole immersed in the dye-vat. Those portions of the hank which are compressed in the knot will retain their original colour, whilst the other parts will receive the colour of the dye in which they were immersed. The junction of the colours will not be marked by a distinct line, as in the present system of dyeing, but they will run into or gradually blend with each other, and consequently a much better effect will be produced.

WILLIAM LAIRD, of Liverpool, merchant, and EDWARD ALFRED COWPER, of Handsworth, engineer. *For improvements in machinery for loading and discharging certain descriptions of cargo in ships and other vessels, and in the construction of such vessels.* Patent dated November 19, 1850.

The improvements here claimed comprehend—

1. A method of loading vessels with coal, and other cargoes of a similar nature, by means of an endless revolving chain of buckets or blades moving in a vertical trunk.

2. The employment of an endless traversing web of sacking or wire-work, placed horizontally, for receiving the cargo from such vertical trunk, and distributing it in the hold of the vessel.

3. A method of loading such cargoes by means of a vertical trunk kept constantly filled, and from which portions of the contents are removed from below, so as to cause them to have a gradual descent instead of sudden fall.

4. The employment of a hanging rail, with travelling snatch-block and other appurtenances, suspended to the deck beams, for loading and discharging cargo.

5. A peculiar construction of barge composed of a series of compartments (open or covered according to the nature of the cargo) fitting into a frame either buoyant in itself or deriving its buoyancy from air vessels or tanks at its ends.

Specifications Due, but not Enrolled.

THOMAS SHORE, of Exwich, Devon, miller. *For an improved method of dressing flour.* Patent dated November 14, 1850.

PAUL DE TOLSTOY, of Paris, France, general in the service of His Majesty the Emperor of Russia. *For improvements in dredging machines.* (A communication.) Patent dated November 19, 1850.

JOHN JAMES GREENOUGH, of the Strand, Middlesex, gentleman. *For improvements in the construction of chairs, couches, and seats, parts of which improvements are also applicable to various purposes where springs for supporting heavy bodies and resisting sudden and continuous pressure are required.* (A communication.) Patent dated November 21, 1850.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Longmaid, of Beaumont-square, gentleman, for improvements in treating ores and minerals, and in obtaining various products therefrom, certain parts of which improvements are applicable to the manufacture of alkali. May 10; six months.

Hugh Barclay, of Regent-street, Middlesex, for improvements in the means of extracting or separating fatty and oily matters, in refining and bleaching fatty matters and oils, animal and vegetable wax and resins, and in the manufacture of candles and soap. May 19; six months.

Perceval Moses Parsons, of Robert-street, Adelphi, civil engineer, for improvements in cranes capable of being used on railways, and in parts of railways. May 19; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
May 15	2815	Palmer and Nevill	Liverpool-street, King's-cross	Ready reacher.
,,	2816	Mathew Naylor	Newgate-street	Shirt and chest protector for waistcoats.
16	2817	James E. Boyd	Lower Thames-street	Double action or self-adjusting scythe. 150 Prov. Reg.
,,	2818	Hyam Hyams	Cornhill	Traveller's indispensable. 146 ,, ,,
,,	2819	Hyam Hyams	Cornhill	Object glass. 24 ,, ,,
,,	2820	Charles Burton	Broadway-terrace, Camden-town	Infant perambulator (child's carriage).
,,	2821	A. N. Dare	Piccadilly	Shirt collar.
17	2822	Fowler and Fry	Bristol	Scavanging cart.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

May 16	216	Mrs. Catherine Billamore	Weymouth-st., Portland-place	Invalid's chair.

CONTENTS OF THIS NUMBER.

Description of Messrs. Napier and Son's Patent Lithographic Press—(*with engravings*) 401
On Impossible Equations. By Robert Harley, Esq. 402
Naval Architecture (Review):
White's "Theory and Practice" 404
Griffiths' "Marine and Naval Architecture 405
Theory of the Rotary Engine.—Error in Tredgold Corrected 409
Marsden's Registered Syphon Funnel—(*with engravings*) 410
Practical Application of Magneto-Electricity—Mr. Shepard's (Nollet's) Discoveries 410
Staite's Electric Light—Manchester Experiments 411
Specifications of English Patents Enrolled during the Week:
Rock ......Carriages 412
Spence ......Alum 412
Marsden ......Scissors and Thimbles ... 412
Wimshurst ......Propelling 413
Ball ......Ovens 413
Medhurst ......Gas-Meters 413
Booth ......Gas 413
Nye ......Hydraulic Machinery ... 413
Masson ......Vegetable Preparation ... 414
Clark & Mapple..Electric Telegraph 414
Ashe ......Circle Sailing 414
Duckworth ......Chicory 414
Howarth ......Nap Raising 415
Liebhaber ......Blasting 415
Allemand ......Lighting 415
Swindells ......Reducing Metals 415
Allan ......Electric Telegraph 416
Haley ......Looms 417
Martin ......Grain Cleansing 417
Coats ......Turning Wood, &c. 417
Newton ......Pigments and Paints 417
Dunn ......Railways 418
Hosking ......Pump Valves 419
Ripley ......Dressing and Finishing ... 419
Brown ......Pumps 419
Kurtz ......Dyeing 419
Laird & Cowper..Loading and Discharging 419
Specifications Due, but not Enrolled:
Shore ......Flour Dressing 419
De Tolstoy ......Dredging 419
Greenough ......Chairs, Couches, &c. 419
Weekly List of New English Patents 420
Weekly List of Designs for Articles of Utility Registered 420
Weekly List of Provisional Registrations 420

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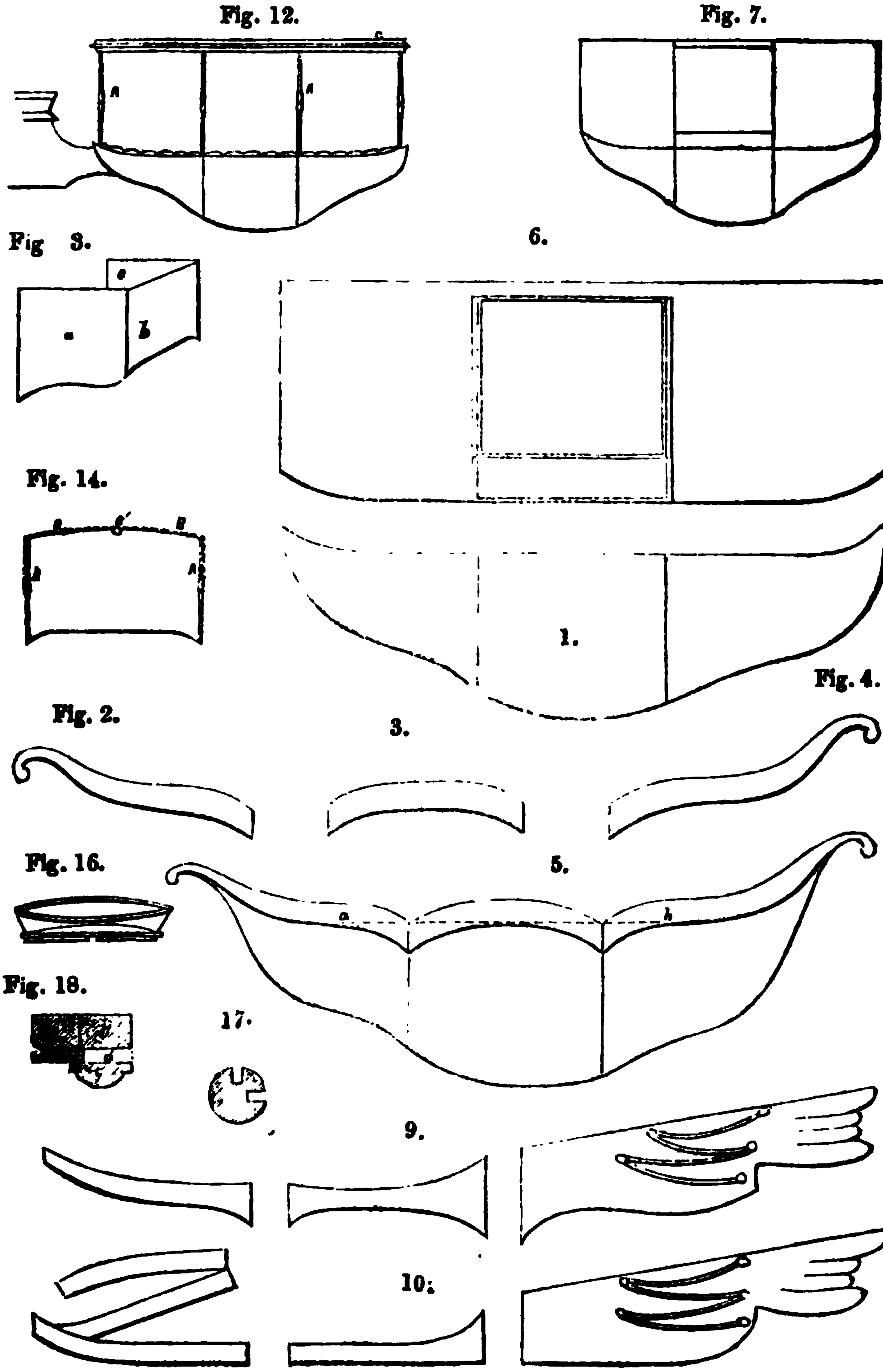
ROCK'S PATENT IMPROVEMENTS IN CARRIAGES.



ROCK'S PATENT IMPROVEMENTS IN CARRIAGES.

(Patent dated November 9, 1850. Specification enrolled May 9, 1851.)

The great superiority of the English pleasure carriages exhibited at the Crystal Palace over those of foreign production, not only in point of strength and fitness of construction, but of elegance of design and decorative embellishment, is a very generally admitted fact, and one which has struck most people with surprise, for public expectation had—for some reason or other which we cannot explain—run quite in a contrary direction. The foreign exhibitors who come nearest to the English in this department are the Belgian; and the foremost of these owns a name (Jones) which would seem to indicate that he is of English origin. Among the English carriages which most attract the attention of visitors, is the improved Diorapha of Mr. Rock, of Hastings—a three-in-one carriage, of the peculiarities in the construction of which, our readers will find a full account in the following extract from Mr. Rock's specification, just enrolled.

Specification.

Firstly. My invention has relation to that class of carriages which are made with moveable or shifting heads, in order that they may be used sometimes open and sometimes closed, and to the modes of throwing open or shutting up such carriages, and to the forms most proper to be given to the fixed and other parts of the same. By the term "head" I mean all that part of the carriage which is above the elbow line.

A principal object in the improvements embraced under this head of my invention has been to form the moveable or shifting parts above or on the elbow line, of such shapes that by the leaving out of some, or substitution of others, the general form or appearance of the carriage may be varied to a much larger extent than has hitherto been practicable.

Fig. 1 of the annexed engravings represents the body of a carriage of a common and usual design. Figs. 2, 3, 4, are moveable head parts, which may also be of any other suitable lines or curves, and which being fitted upon the body, shown in fig. 1, give it the appearance represented in fig. 5, where the original elbow line is shown by the dotted line *ab*. Fig. 6 shows an entire moveable head, and fig. 7 shows the head fig. 6 in its place on a body of the shape represented by fig. 1; the lower line of fig. 6, and the upper line of fig. 1 being similar or coincident. Fig. 8 exhibits one of the appearances which a body like fig. 1 will have when the lower line of the head, fig. 6, is made dissimilar from the upper line of the body, fig. 1. Figs. 9 and 10 represent moveable folding heads, door-top pieces, and front elbow-pieces, all or any part of which may be adapted to a body of the shape shown in fig. 1, and the appearance thereof varied accordingly as exemplified (in reference to fig. 9) by fig. 11. Fig. 12 represents a body of that description of carriage called a "Dioropha," fitted with a moveable canopy; and canopies of this description may be also applied to bodies constructed with moveable elbow-pieces, or with one or more moveable heads as shown in previous figures.

Fig. 13 shows the manner in which the hinder part of the canopy head may be closed when required. The panels *a*, *b*, *c*, which are drawn in perspective, and may be either separated or united by hinges or otherwise, are to be made to fit into grooves formed in the lower part of the canopy roof C (fig. 12), and rebated at their lower edges to shut down over the upper edge of the body so as to exclude wet. I support these canopy heads by means of pillars or rods, and I make the roof or covering to roll or wind upon a roller passing over the centre of the body from back to front. Fig. 14 is a back view of part of the same. A A, in both figs. 12 and 14, are the put on pillars, B the covering, and C^1 the roller.

In the case of carriages, such as the Dioropha, the plan which I find most generally suitable is to make the under line of each head and its appendages different from those of the other, and to provide a separate set of elbow and door-pieces to put on when the carriage is to be used without either head.

I am thus enabled to make one carriage serve the purpose of three carriages; that is, first, a close carriage; second, a half-headed or barouche carriage; and,

third, an entirely open carriage. I also provide moveable elbow and door-pieces to complete the elbow line of an open carriage, when such carriage is furnished with a moveable head or heads, irrespective of any change of curve in the said elbow line.

Another method by which I make the bodies of carriages open or close as may be desired, is represented in fig. 15. Instead of taking off the whole of the head of a close-bodied carriage as if it were one piece, as before described, I make the roof with hinges or joints, so as to fold backward upon the hind part of the head, which I then remove with the roof attached. When it is required to make the parts removed more convenient for stowage, I make the upper quarter and the back panels with hinges, joints, or other fastenings, so as to permit of their being folded up compactly, as exemplified in fig. 16.

Fig. 11.

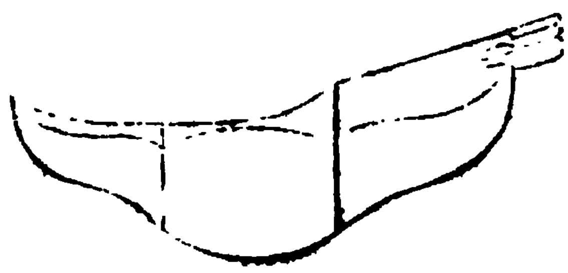


Fig. 8.

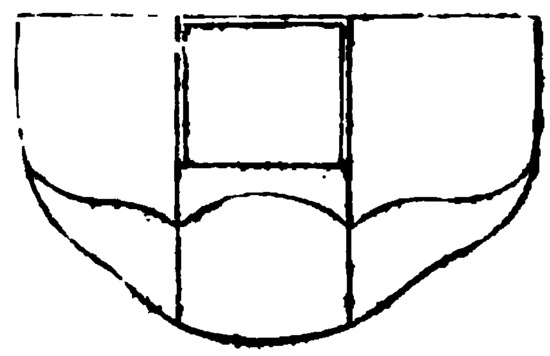


Fig. 16.

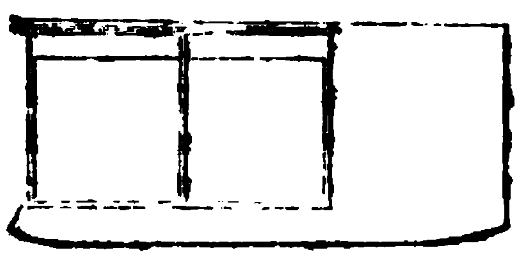
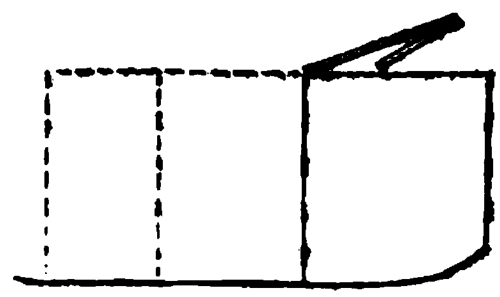


Fig. 15.



In some cases I remove or take off the whole of the roof by itself, and the hind-quarters and back-panels by themselves; I also sometimes make the parts occupied by these panels of leather, so arranged as to fold in the same way as the corresponding parts of landaulette.

The mode of disposing of the glasses and pillars (where necessary) is as follows. I form a recess in each hind-quarter of the head capable of receiving the door-glass and the front quarter glass of the corresponding side of the carriage, either together or single, so that when the head is removed, as before described, the side glasses may go with it.

The front glass or glasses is or are made to let down into the body, as also the hind glass or panel. Fig. 17 is a cross-section of the front corner pillar of the carriage represented in fig. 12, showing the grooves to receive the side and front glasses. Fig. 18 is a sectional view of the door and standing pillars; *a* is the standing pillar, *b* inner part of door pillar, *c* outer part of same, and *d* groove for the glass frame *e* to pass through.

I make the pillars of iron or other metal, in the case of close carriages, in order that there may be less to obstruct the view from the interior than when wood is employed, and in such carriages I also cause the front quarter glasses to slide backwards into the hind quarter or to drop into the doors; the door pillars being grooved, to admit of the same.

FINCHAM'S HISTORY OF NAVAL ARCHITECTURE.

Sir,—I beg to offer to yourself and your readers the following observations, with reference to Dr. Woolley's letter, inserted in your Journal, No. 1447.

You will have observed, that the passage in my History of Naval Architecture, to which exception is taken, is a foot-note, and that to an historical, not

a didactic method of treating the subject. If it should appear, on the testimony of the highest authorities, that the rule made use of to calculate the displacement of ships, is an *approximate*, and not an *exact* rule, then I presume it will be admitted that the "*grave responsibility*" under which Dr. Woolley supposes I have placed myself, by calling attention to the subject, is sufficiently met. But, according to that letter, the responsibility may lie upon either myself or my "mathematical advisers." It is nearly forty years ago that I became associated with Dr. Inman, at that time Professor at the Royal Naval College. The late School of Naval Architecture, in its initial state, was then under his charge. We at once entered into each other's views; and from that time I had the honour to regard that distinguished man as my "mathematical adviser;" and I still cherish the recollections of our association and friendship, with the liveliest sentiments of respect and esteem, for his great abilities and his honourable character: nor can I allow these feelings to be interrupted by an ungenerous allusion to my *mathematical adviser*. To Dr. Inman's appointment to the post he held long and honourably the ship-building department of this country owes the highest improvements in all the forms of calculation that are used in naval architecture. There was gross inaccuracy before; and this prevailed every where, in the public, as well as in the private service. He collected the best works that had been published on the subject; amongst which were the writings of Chapman, the eminent Swedish Naval Architect, and those of Mr. Atwood, in the Philosophical Transactions of the Royal Society. The latter were purely theoretical; the theory was at once applied; and Dr. Inman and I proceeded to calculate the displacements of two ships in the British Navy; he, as my "mathematical adviser," giving me all the information which could be necessary. The method of calculation was that indicated by Simpson's formula, in which the ordinates were the only measures of the ships of which cognizance was taken; so that Dr. Woolley's "new mode of finding the displacement by a single operation, from the ordinates *only*," may not perhaps be found to include any remarkable features of originality, seeing that *ordinates only* have been used in such calculations from the time of Dr. Inman's appointment to the School of Naval Architecture to the present day. I have made numerous calculations by applying Simpson's rule; and have taken considerable pains in training young men to be employed as draughtsmen, in the several dockyards in which I have had the honour of occupying the highest professional station, to make the calculations required in naval architecture; and I do not hesitate to affirm, that such persons have become both expert and accurate in the discharge of their duties; and, without making any comparison between their work and that or Dr. Woolley, I confidently allege their merit to far other epithets than "incorrect and slovenly," which he has thought proper to apply to their calculations.

That I had no desire to produce in "practical men" a distrust in the rule, as to a satisfactory approximation, is evident from every part of my "History of Naval Architecture," in which it was necessary to refer to the method of calculation in question, or to present the results, by stating the displacements of ships and vessels; and also from a work which I published twenty-six years ago, in which I inserted the formulæ for making the calculations, and illustrated their use by examples. And Dr. Woolley knows that I approve of the approximation, *as such*, from every form of evidence he could have, being the nearest approximation that is known. When he was appointed to the Central Mathematical School for apprentices, nearly three years ago, I cordially rendered him such assistance as might be necessary to facilitate to him a course of new duties, being in the line of my experience; and in doing so, I gave a practical and unequivocal expression of my appreciation of the rules for calculating the displacement of ships.

Dr. Woolley knows that it was not necessary, as a guard to the boundaries of science, nor to support the confidence of practical men, that he should write that letter. I shall leave the public to draw such inferences as may appear the most credible, why he has attempted to discredit the correctness of the note at p. 45 of the Introduction to my History.

But the question at issue, *if there is*

any question, is, whether the rule is intended to give an *approximate* or an *exact* result? Chapman's method of approximation is identical with that of Simpson; and indeed, there is reason to suppose that he adopted Mr. Simpson's theorem. Whilst this differs in form from that of Mr. Stirling, its results differ in a degree hardly appreciable. There are then, in fact, only two rules in use, both of which give near enough approximations to the truth, for the common practical purposes of Naval Architecture. In saying there are only two rules in use, it is clear that I except a third, which takes no account of the curve bounding the area, thus admitting too great an error to be allowed in Naval Architecture.

The following is from a note in Mr. Atwood's first Paper on Floating Bodies: "Methods of *approximating* to the areas of curves, founded on the differential series, are given by several authors, particularly by Stirling and Simpson. Admiral Chapman proposes a very ingenious method of *approximation*, depending on the properties of the parabola; either is *sufficiently exact* for the purposes of practical geometry: but of the two methods, that of Mr. Stirling is the *most correct*." [Philosophical Transactions, Anno, 1796; p. 114]. The next authority to which I shall beg to refer you, is the pamphlet which Dr. Inman published about two years ago, and to which Dr. Woolley has referred. At page 3, Dr. Inman says, "If the half transverse sections, and half-water-lines were of known geometrical form, the areas thereof might generally be determined accurately. But, in fact, these curves are seldom drawn according to any determinate geometrical law; so that it is only possible to find such areas and the other results dependent thereon, *in an approximate degree*." Dr. Woolley has referred also to Mr. Creuze, as an authority on this subject; I beg therefore to add the following quotation from his Treatise on the Theory and Practice of Naval Architecture. "As the body of a ship is not generally any regular figure, the rules which determine the contents of regular solids will give only *approximations* when applied to finding its content. It is evident that the correctness of the *approximation* of the parabolic area to the area of the required curvilinear space, is dependent on the distance between the ordinates; as on that depends the nearer or the more remote coincidence of the parabolic curve with the curve bounding the area required."

It is admitted then, by authorities in the highest repute, that Simpson's formula for determining the areas of curved surfaces gives only an *approximate* result; but in getting such result, the data are *exact* quantities, the ordinates being certain determinate lengths, known by measurement. And, moreover, there is not a great difference in the lengths of any of the consecutive ordinates; so that the space falling between the actual curve, and the supposed curve, would be very small, provided the interval between the ordinates were not great. Now the areas of the sections found by the first process of calculation, take the place of ordinates, and are used exactly in the same manner, when the solid content is to be ascertained. These are, however, very large multiples of the original magnitudes, or ordinates; and some of these consecutive ordinates,—as they may with propriety be called, with reference to the use which is made of them—are, to so great an extent dissimilar in magnitude, that the line which would pass through the extremities of any given number of them, would differ more widely from a parabolic curve than it would in the case of finding the *areas* of the sections. The greater the dissimilarity between the supposed and the real curve, the less near to the truth would be the approximate result. Upon this ground the solid content of a ship's displacement cannot be so near to the exact measure as the areas of the sections are. The error may not, that I am aware of, affect in the slightest degree, any important consequence depending on the calculations; for those who are conversant with this subject know that calculations conducted according to the rule, are a satisfactory guide in practice.

Nevertheless, truth, in its most rigid exactness, is preferable to the nearest approximation, when the choice lies between the two. This was, therefore, a sufficient motive with me to suggest, in that place, to scientific men, that something was yet needed to precision in our mode of calculation—that if their speculations should be directed to this particular subject, they might advance the

interests of naval architecture by rendering precise and definite that which yet includes any, however small a degree of uncertainty, in developing its results.

In taking so much notice of Dr. Woolley's letter, it may be right to assure the readers of the *Mechanic's Magazine*, that my motive has been most distinct from a love of controversy; and I have no intention to enter into a controversy with Dr. Woolley. Further, as the point in question was by no means likely to affect either the science or the practice of naval architecture, I almost resolved not to take the slightest notice of his letter; but silence might be misconstrued; and the apprehension of this gave a different bias and determination to my purpose. The interests of that subject which has absorbed the thoughts and energies of half a century of my life, cannot be lightly let go now. It is the love which I bear to my profession, and my desire to see it advance to the highest degrees of excellence and accuracy, that have induced me to request of you the favour of inserting this letter. It might have been quite consistent with the terms of intercourse in which Dr. Woolley and I have lived since he came to this place, that he should have pointed out to me privately any statement in my book which appeared to him of doubtful accuracy. He has not, however, chosen to take the course which courtesy might have suggested; and hence I am unable to take any notice of his objection, except in a public manner, and as being now required to do so on public grounds. I rest the vindication of my note on the concurrent testimony of the most able and scientific men who have written on the subject.

I am, Sir, yours, &c.,

John Fincham.

Portsmouth Dockyard, May 17, 1851.

PUBLICATION OF PATENTED INVENTIONS.

Amongst the many improvements of the law of patents that have lately been suggested, no one seems more difficult of accomplishment than that of giving publicity to patented inventions in a classified notification of them, at a cheap rate of expense to the inquirer, and including all the patents heretofore granted, no less than future ones. Information of this nature is of real importance to inventors, since, without it, they cannot ascertain whether what they conceive to be new has already been patented or not. Article 11 of Lord Brougham's proposed Act provides for the inspection of future patents at the Great Patent Seal-office, and article 12 for the printing and publication of them; but this would afford no intimation of bygone patents. By some other plans the expediency has been suggested of rendering public in some way all patents already past as well as future ones. To a very limited extent this has been already done in the "Repertory of Arts," and lately the *Mechanics' Magazine* has given an abstract of all the patents that had been enrolled in the week prior to its weekly publication. Not any of these plans suffice to inform a projector whether what he conceives to be his own invention has already been patented or not, or whether it may not have been in practice, or published, though not patented—circumstances on which the validity of any patent he might have in view must depend, and which it must be to his interest to ascertain, though he might have to pay for a patent but Mr. Charles Dickens's "half-crown or so"—still more where the cost amounts to a hundred or more pounds.

As inventions, the subjects of patents may, and do, relate to every branch of science, art, and manufacture, any publication that should embrace all the inventions that have been or may be patented would necessarily be both voluminous and costly; it therefore would seem expedient to divide an account of patents under distinct heads, as many as the subject matters might admit of, with a view to classification, whereby information on each division might be obtained separately, and at a low price.

The bringing together under any particular head what has already been done in relation to it would, in fact, constitute a history of inventions—as, for example, that of steam navigation by Professor Woodcroft, and of lighting by gas in *Chambers' Edinburgh Journal*. In the same manner, the whole series of arts and manufactures susceptible of being patented, might be arranged and published under distinct heads.

Magnetism and electricity may be instanced as affording matter for very use-

ful histories, both as to their combined influence in producing effects, or separately as applied to particular arts, or manufactures, or general utility. As sciences, magnetism and electricity are still in their infancy; but the progress that has already been made in applying these powerful agents to the arts even now is capable of division into many important branches. The mariners' compass, from its first known origin to the means so lately resorted to for rendering it a *true*, instead of, as it so often was, a *false* guide in oceanic navigation; the subjecting electricity to our command as a messenger swifter than the wind; the deposition of one metal on another; the attempts that have been made to use magnetism as a motive power;—all of these afford scope for historical accounts of the patents that have been taken under these and other heads, and which could not fail of being eminently useful as exhibiting what has already been patented, and what still remains open to future inventors as patentees.

The patents relative to wood afford an instructive example of the mischiefs that have arisen from a want of their having been made generally known. The public have been deprived by recent patents of their undoubted right to use inventions for which a patent had lapsed before the more modern ones were taken, as in the instance of most of the machines for cutting and shaping of wood. A history of machines for cutting and shaping this material would need to be divided into distinct parts—not the history of this or that particular machine for such or such a specific purpose, but that of machines for performing one and the *same class of operations, e.g.*, machines for dividing wood in straight directions, those for dividing it in curved directions, for giving it angular or curvilinear forms, for piercing it, for excavating portions of it, and so on. Metals, in addition to the same particulars as above indicated for wood, would require histories of the several combinations of them. The fabrication of filamentous substances into yarn, thread, strings, cordage, and woven goods, would furnish matter for several useful histories. That of hair, to a fewer number, but of considerable interest on account of its peculiar formation, on which the operation of felting depends, and which has, till very lately, been scarcely taken advantage of in this country, excepting for the making of hats. Ship-building would be given under several grand divisions, and their minor sections are many of them worthy of separate detail. The form of the hull, as most suitable for making its way in smooth and in troubled water, would constitute one grand division; the means of giving the hull strength on mechanical principles, another; apparatus for producing locomotion; a third, including locomotion by manual exertion, by the impulse of the wind, by steam. But it is needless to point out farther examples of arts and manufactures for which patents have been taken that are most of them little known, and their existence on the spur of sudden occasion difficult and costly of ascertainment.

Materials abound wherewith to frame histories of the kind above indicated. Ancient authors and descriptions of ancient monuments would furnish information as to the practices of former times; there are old German publications which give descriptions and engravings of machines, exhibiting some that have since been introduced here as new inventions; the Italians are strong in hydraulic engineering; we have at home the *Mechanics' Magazine* and other periodicals, cyclopædias, books on naval architecture, very curious but little known manuscripts in the British Museum; we have patents for inventions in the original, which would of course be consulted when not given verbatim in any of the scientific journals, the transactions of the Royal, and other scientific societies, afford much information; so would the Records of the Admiralty and other naval boards, for it is well known that many useful inventions have been submitted to them, but which have been unfortunately neglected, and in a manner lost to the public.*

To render such histories as are above contemplated of general utility, they should be published at the lowest possi-

* Many important official documents on naval matters have been ascertained to have been stowed away in packing cases, so as to have been virtually un-come-at-able; and it has been affirmed by good authority that in the course of the present century papers in the naval department were for about thirty years *destroyed*, to save the trouble of preserving them.

ble remunerative price. Weale's Rudimentary Treatises afford an example of the quantity of useful matter that can be furnished for a very trifling sum; the history of lighting with gas, above-mentioned, occupies but a few pages of Chambers' three-halfpenny weekly publication. The "Edinburgh Journal," it is true, pays on account of its extensive sale much more than could be expected for any purely scientific book confined to a single art or manufacture. The need of such publication is farther indicated by the want of books on arts and sciences in even the most abundantly furnished circulating libraries.

But a very low-priced publication could afford little or no compensation for time, trouble, and ability bestowed in authorship; men already established in scientific, engineering, or manufacturing concerns, could not be expected to devote themselves to the compilation of such histories, nor would any fund that could be set apart for such a purpose out of fees for patents be likely to prove sufficient for the adequate payment of compilers; there is, however, one description of competent persons who would indirectly be sufficiently remunerated for such labour; namely, young engineers, architects, chemists, &c., who having completed their pupillage or studies are as yet without professional engagement. Too many competent persons of this description are unfortunately without employment, and their leisure would be usefully occupied for themselves and for the public in describing the successive inventions that have been devised in each particular branch. Each person would of course select the branch with which he might be best acquainted, or for which he had the strongest predilection; were it merely for his own improvement, such a task would have its reward in the shape of information gained, but, besides this, no better recommendation to public notice and employment could be obtained than the evidence his book or pamphlet would afford of intimate knowledge of the subject of it, and the care and skill with which it was drawn up. Some general director of such an undertaking would evidently be requisite, were it only to register and point out the several portions of the work on which competent persons might be already engaged—the general idea once adopted, details of execution would easily be fixed upon.

In drawing up such histories it would be essential to consult only *original records*, and in many cases a reference to them would be desirable — general report should never be considered proof, nor should hearsay or partial evidence be admitted of. In these respects some of our best books on arts and manufactures have failed. In "Ure's Dictionary of Arts, Manufactures, and Mines," for example, article "Block Manufacture," the machinery for this purpose at Portsmouth is spoken of as "so admirably *devised* and *mounted* by M. I. Brunel, Esq.," without the least allusion to Walter Taylor as the inventor of the circular saw, or of its improvement by Sir Samuel Bentham, or of his machinery already in use in Portsmouth Dockyard, and which formed a very considerable part of the so-called Brunel machinery. A single misrepresentation of this nature is liable to raise a doubt as to the accuracy of other articles, even in a dictionary so ably executed as is that in question, and by a man so eminent as Dr. Ure for science and general information. Much more would it behove young men to rely solely on *authentic* documents.

It is almost superfluous to add, that supplementary additions to these histories would from time to time be requisite.

M. S. B.

MR. FROST'S "STAME."

Sir,—I forward you an account of an experiment made with additional apparatus attached to the engine, already described in your valuable work, as the details thereof may be more intelligible, and if so, may be more satisfactory to many of your mechanical readers than the wonderful, though indisputable, chemical facts already adduced to show the vast value that "stame" must possess over steam, if properly understood and applied.

This engine has sufficient condensing pipe inserted in a large cistern of cold water, by heating which water the comparative quantities of heat in the steam and in the "stame" is measured. It has a mercurial gauge for measuring the extent of vacuum; it has a small separate cistern for receiving and measuring the

quantities of condensed water that were respectively contained in the steam and stame under examination; it has a dynamometer, consisting of a friction wheel fast on the shaft of the engine, to which wheel a long lever is attached by a screwed strap, by tightening which the double purpose is obtained of regulating the speed of engine, and correctly measuring the comparative power of engine, by means of a spring dial attached to the end of lever.

	Revolutions of Engine.	Increase of Heat in Large Cistern.	Condensed Water in Small Cistern.	Pull of Dynamometer at Commencement.	Pull of Dynamometer at Termination.	Vacuum during Experiment.
Steam	2,000	14	2	10	5	26 Ins.
Stame	2,000	8	1	10	20	26 Ins.

Then as the engine, at conclusion of experiment, was doing four times the work with half the water, and with eight-fourteenths the heat, it is evident the fuel employed for "stame" was more than seven times as efficient as the fuel employed for steam.

I have obtained, and can at any time obtain, much more than four times the effect from fuel employed for "stame" than from the same amount of fuel employed for steam in a high-pressure engine, and much more than six times the amount of force from fuel employed for "stame" than from fuel employed for steam in a low-pressure engine; and I am able to show the causes of my superior attainments.

In fact steam, in comparison with "stame," is but a puerile agent; but so great a discovery is naturally too great for the uneducated to comprehend—and the educated of the present generation were faithfully described by Hudibras:

> "They know whatsoever's to be known,
> And much more than they know will own."

I am, Sir, yours, &c.,

JAMES FROST,
Engineer.

Fulton Avenue, Brooklyn, New York,
May 7, 1851.

THE FIRST IDEA OF THE ELECTRIC TELEGRAPH. BY N. S. HEINEKEN.*

In the Number of the *Philosophical Magazine* for May, I observe that Professor Maunoir claims for his friend Dr. Odier the first idea of the electric telegraph. I herewith send you a translation from a German work by Schwenter, entitled *Deliciæ Physico-Mathematicæ*, and published in 1636, from which it will appear that the *crude* idea of the electric telegraph was entertained upwards of a century before the period alluded to by Professor Maunoir. Indeed, Œrsted's grand discovery was alone wanting to perfect the telegraph in 1636. The idea, in fact, appears to have been entertained prior even to this date, for Schwenter himself quotes from a *previous* author.

Sidmouth, Nov. 12, 1850.

"*How two People might Communicate with each other at a Distance by means of the Magnetic Needle.*

"If Claudius were at Paris and Johannes at Rome, and one wished to convey some information to the other, each must be provided with a magnetic needle so strongly touched with the magnet that it may be able to move the other from Rome to Paris. Now suppose that Johannes and Claudius had each a compass divided into an alphabet according to the number of the letters, and always communicated with each other at six o'clock in the evening; then (after the needle had turned round 3½ times from the sign which Claudius had given to Johannes), if Claudius wished to say to Johannes—'Come to me,' he might make his needle stand still, or move till it came to *c*, then to *o*, then to *m*, and so forth. If now the needle of Johannes' compass moved at the same time to the same letters, he could easily write down the words of Claudius and understand his meaning. This is a pretty invention; but I do not believe a magnet of such power could be found in the world."

Quoted from "*The Author*" by Schwenter, in his *Deliciæ Physico-Mathematicæ*, p. 346. 1636.

* From the "London, Edinburgh, and Dublin Philosophical Magazine" for December, 1850.

NASMYTH'S ABSOLUTE SAFETY VALVE.

(Registered under the Act for the Protection of Articles of Utility.)

The absolute safety valve, represented in the above figure, has met with very general and high approval, as uniting in a most simple combination all the qualities which can tend to the formation of a true and perfect safety valve.

The total absence of all spindles or other guiding agencies, which have hitherto proved so fertile a source of mischief and uncertainty in the action and permanent perfect condition of this vital part of a boiler apparatus, will be seen at a glance, to characterise the design of this "absolute safety valve."

The chief feature of novelty, however, which distinguishes this improved safety valve from all others hitherto proposed, consists in the peculiar and simple manner in which the motion of the water in the boiler is employed as the agent by which the valve is prevented from ever getting set fast in its seat. The swaying to and fro sort of motion which at all times accompanies the ebullition of water in boilers is made to act upon a sheet-iron appendage to the weight, which weight is directly attached to the valve, and as the rod which connects this sheet-iron appendage and weight to the valve is inflexible, it will be easily seen how any slight pendulous motion given to the sheet-iron appendage is directly transferred to the valve; and as that portion of the valve which rests in the seat is *spherical*, the valve not only admits of, but receives a continual slight motion in its seat *in all directions*, as the result of the universal pendulous motion of the appended weight, as acted upon by the incessant swaying motion of the water during ebullition.

It will be seen, that as the spherical portions of the valve and seat are of equal width, the edges of their respective

surfaces pass and repass each other continually, and so maintain, and continually tend to improve the perfect spherical fit and agreement between the valve and its seat. It may be proper to observe, that when the steam is near up to the desired pressure, the valve rests on its seat, with a pressure next to no pressure at all, and is then, as it were, floating on steam. This action is common to all good valves, but the observation may tend to show how a slight movement of the water affects the valve in its seat.

Bridgewater Foundry, Patricroft, May 9, 1851.

NAVAL ARCHITECTURE.—WHITE AND GRIFFITHS' TREATISES.

(Review continued from p. 499.)

To return to Mr. Griffiths' exposition of the fundamental principles of fluid pressure: After stating that the pressure of water at rest at any point varies as the depth of that point below the free surface—he favours us with his explanation of the hydrostatic paradox, and gravely adduces the case of a vessel lying alongside a wharf or pier as an illustration of it; the small column of water on one side of the vessel being in equilibrium with the river's whole breadth on the other. Now this we venture to assert never struck any one as a paradox at all, and a moment's reflection will show us, that there is no more wonder in this circumstance than in the fact that the water near the side of a canal is not in a constant state of motion from the more open part. The hydrostatic paradox, which is well illustrated in the hydrostatic bellows, consists in the fact, that a very small weight of water may be made to produce an enormous pressure, and thus sustain on a flat form a very large weight. If two flat boards be united round their extremities by leather, or other similar elastic substance, made water-tight, and the interval between them be filled with water, and an open tube of as small a bore as you please be connected with these boards, communicating freely with the open space between them, and forming a kind of termination to it; then by pouring small quantities of water into this tube, and thus raising the column of water in it considerably, we may make the upper board support a very large weight. Suppose now that our tube has a section of an inch square, and that the water stand at a certain height in it; if we now pour in seven ounces weight of water, the column will rise in the tube to another foot of altitude; and if the upper board have a surface of 20 square feet, this small additional weight of water will support an additional weight of 1,260 lbs., or rather more than half a ton on the upper board. Every particle of matter is capable of attracting every other particle if brought within the sphere of its influence; and in every solid body each particle is attracted by all the other particles near it. To such attractions the name of molecular forces has been given. Of course, when a body is in a state of *rest*, and therefore its particles do not move or change their place relatively to one another, the *resultant* attraction on each particle, and the resultant of the molecular forces acting upon it must be zero, although the attraction of any single particle upon it may be very considerable. If then, a solid body be at rest under the action of any external forces, these molecular forces need not be taken into consideration, because their resultant upon each particle is zero; and when the body is in motion, although the resultant on each particle is not zero, yet, throughout the whole body these resultants are in equilibrium. Of the magnitude of these internal forces an idea is gained when an attempt is made to separate the particles of the body from one another by cutting it with a knife or saw, or other instrument. It is found that very considerable resistance is offered to such separation; but when once the separation is effected, however near the parts are brought together, the molecular forces are no longer able to unite them; whence we conclude, that in solid bodies the molecular forces are very considerable, but their sphere of attraction is within very narrow limits—narrower almost than we obtain a conception of. In fluids, on the contrary, the molecular forces are very inconsiderable in amount, as appears by their yielding to the action of any force

however small (which is the case in a perfect fluid); but the sphere of their action is enlarged, whence arises the readiness with which the particles of a divided fluid reunite; whence also their tendency, which Mr. Griffiths describes as their great characteristic *to form drops*. The truth is, that solid bodies, as well as fluids, are all under the action of molecular forces, but with the essential difference explained above. So long as its particles are relatively at rest, a fluid does not differ as respects equilibrium from a solid. When, however, motion ensues, the circumstances are entirely altered; it is then only in the case of *motion* that fluids require to be treated on different principles to solids. The readiness with which the particles of a fluid yield to the action of any forces, such as attraction of other bodies, is seen by the adherence of its particles to the sides of a vessel containing it; by its surface at the edges being somewhat elevated or depressed, as in the phenomena of capillary attraction; but such phenomena exercise no appreciable influence over the conditions of equilibrium of the fluid, although in our author's conception they are the main agents in it; and to their effect he gives the high sounding name of *equilibriated gravity*. Moreover, when our author speaks of the "dew-drop standing out in drastic contrast with solid bodies, similarly circumstanced," we would beg to remind him that the dew-drop *weighs* neither more nor less than a solid of the same form, size, and density would do, and produces *exactly the same effect* in depressing the leaf or blade of grass on which it stands. We cannot spend more time in correcting our author's crude notions on fluid-equilibrium; nor should we devote so much space to this task, but for the apprehension that this may be found a question of difficulty to practical men. We therefore beg to assure them that the molecular or internal forces of fluids, like those of solids, may be left entirely out of the question in considering their equilibrium, and that all questions connected with the pressure of fluids on bodies immersed in them are derived from the analogous circumstances of solid bodies taking into consideration the experimental fact that fluids press equally in all directions, and must press on a solid at every point of it in the direction of the Normal.

We should not have spent so much time on these elementary considerations, but for the expectation, that lying within the grasp of so many of our readers, they will be the better able to appreciate the value of Mr. Griffiths' labours in those parts of science which are more abstruse.

It is not our intention to follow Mr. Griffith through all his remarks on the value of the *model*, and his recommendations to substitute it entirely for the drawings to which we are accustomed on this side the Atlantic, for we should tire not only ourselves but our readers. We shall, therefore, offer only a few observations of a more general character. As we shall have occasion hereafter to make frequent mention of displacement and centre of buoyancy, and of the draughts of a ship, it may not be amiss to premise a word or two in explanation of these terms, for the benefit of those of our readers to whom they may not be familiar.

We have already stated, that if any portion of a fluid at rest become solid, its density remaining the same, so as to fill exactly the same space that it did before, its own equilibrium and that of the surrounding fluid will not be disturbed. This furnishes us with a ready means of measuring the *resultant pressure* of the surrounding fluid; for it is evident that the only forces on the solid, in a vertical direction, are its own weight acting through its centre of gravity downwards, and the resultant pressure of the fluid; and since there is equilibrium, these forces must be equal and opposite. Whence it follows that the resultant pressure of the fluid is equal to the weight of this solid, *i. e.* the weight of the bulk of the fluid which would occupy the same space, and *acts upwards* in a vertical line through the centre of gravity of this solid.

It is further evident, that if this solid were removed, and any other body were

placed upon the fluid, so that the part of it immersed should occupy exactly the same space, the resultant pressure of the fluid upon it would be the same. But in this case the floating body will evidently be in equilibrium under the action of its own weight, pressing downwards in a vertical line through its own centre of gravity, and the resultant pressure of the fluid which, as we have seen, is equal to the weight of the bulk of water which would exactly fill the same space as the portion of the body which is immersed and acts upwards in a vertical line through its centre of gravity.

These forces must, therefore, be equal and opposite. Now conceive the floating body removed, the surrounding water not being disturbed. It is evident that a hollow space or cavity would be left, of exactly the same size and form as that portion of the body which was plunged in the fluid. The water (supposing that to be the fluid on which the body is now supposed to float, which would exactly fill up this cavity, so that its upper surface may coincide with the free surface of the surrounding fluid) is called the *displacement*, and its centre of gravity is named the *centre of buoyancy*.

Coupling this with what has been said before, it is evident that in order that a vessel may float in equilibrium on a fluid, it is necessary,

1. That the weight of the vessel should be equal to the displacement.

2. That the line joining the centre of gravity of the vessel and the centre of buoyancy should be vertical.

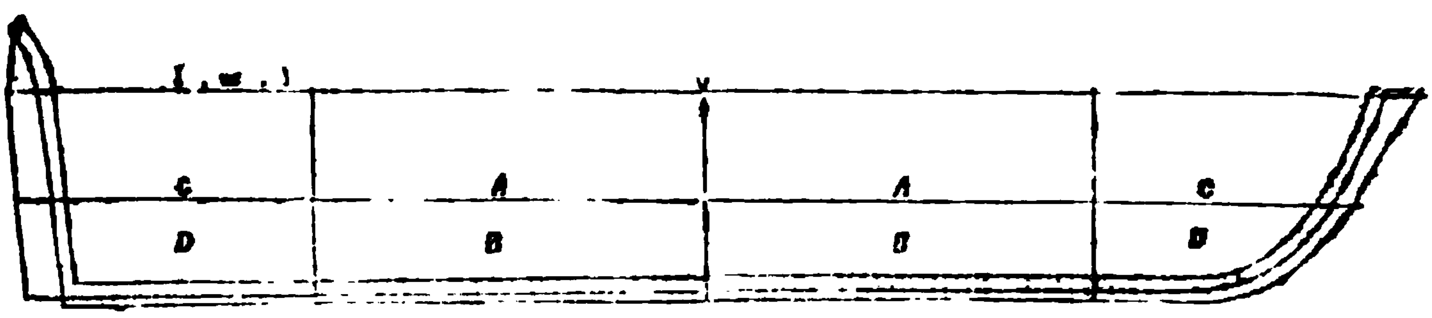
In forming the design of a ship, it is evident that one essential element is its weight, which requires a certain portion of its bulk to be immersed in the water. The surface of the water being a horizontal plane, will evidently meet the surface of the vessel in a line wholly contained in this plane, which is called the load-water line, if the vessel be loaded with all the weights it is destined to carry. If we conceive the vessel to be divided into two portions by the horizontal plane passing through the load-water line, the part above will be entirely outside the water, and the part below will be immersed. If, then, we calculate by any means the solid contents of this immersed portion, the weight of the same volume of water will be the displacement, and its centre of gravity the centre of buoyancy. The draughts of the vessel supply us with the means of making these important calculations.

A ship consists of an assemblage of curved timbers or ribs, which abut at the lower, fore, and aft extremities, on a strong framework of timber, which divides the vessel into two equal and symmetrical portions, and takes the name of stern, keel, and sternpost, according to its position before, below, or abaft the ship. Over these ribs is placed a strong covering of planks, which is admitted into this framework in a groove cut out of it through its whole extent, called the rabbet. Through a great portion of its extent the lower edge of the rabbet of the keel is a straight line. Through this line (the vessel being placed upright) conceive a *horizontal plane* to be drawn; and through the line on the upper face of the keel, which divides it symmetrically, conceive a vertical plane drawn; and lastly, conceive a third plane perpendicular to each of these, dividing the vessel—therefore athwartships, or transversely, and containing the *greatest breadth* to be drawn. On these three planes the principal lines which designate the form of the ship are projected; and we thus have three planes of projection which, in the order in which we have supposed them drawn, are called the half-breadth, sheer, and body planes respectively. These planes evidently intersect two and two in straight lines, mutually at right angles, which may be conveniently designated the *longitudinal*, *lateral*, and *vertical* lines of the ship; and the point in which they meet, or origin of co-ordinates, is distinguished by the symbol ϕ. The lines of the ship projected on these planes form the usual draughts.

It seldom happens that a vessel is so constructed as to float on *an even keel*, but generally it is intended that it should suit

deeper water aft than forward, so that the keel instead of being horizontal inclines upwards towards the stern. It is evident that the draughts which we have just described must undergo some modification in order to render them convenient for making the calculations. The constructor always fixes upon a load-water line. The horizontal plane through this, the sheer plane remaining as before, and a vertical plane perpendicular to these two, and drawn through the bisection of the *length* of the load-water line are made use of for this purpose. The volume of the ship below the load-water line is divided into spaces by an odd number of horizontal planes parallel to the load-water line, and by an odd number of transverse or vertical planes; ordinates are measured at the intersection of each pair of horizontal and vertical planes, and the volume of the solid and the position of its centre of gravity, with respect to length and depth, are calculated by Simpson's rule. Thirty-five cubic feet of sea water weighs very nearly a ton; hence the volume found as above divided by thirty-five gives the displacement in tons.

In order to make the calculations as correct as possible, it is convenient to adopt the recommendation of Dr. Inman in his late work on this subject; and divide each of the two portions, fore and aft, of the principal transverse section, and the section which passes through the middle point of the length into four other portions, as in the accompanying sketch.



In A the change of curvature is very gradual, and the intervals between the sections, both horizontal and vertical, may be taken tolerably larger. In B there is a considerable change of curvature vertically, but not horizontally. The interval between the vertical sections remaining unchanged; that between the horizontal sections must be diminished. In C there is a rapid change of curvature horizontally, but not vertically, while in D the change of curvature is rapid in both directions. C, therefore, may have the same interval between the horizontal sections as A, but the interval between the vertical sections must be diminished; while D must have the same interval between the vertical section as C, and between the horizontal as B.

By such an arrangement, with little labour, a great degree of accuracy in the calculations may be attained. In all cases there will be small portions not included within the planes, the volumes and moments of which must be calculated separately, and added to the former results. The draughts of ships are usually made in this country on the scale of a quarter of an inch to a foot. The rule which is generally applied to this purpose was explained in No. 1443 of this Magazine, and to this we refer our readers for further information on this subject.

Mr. Griffiths gives several methods of finding the centre of gravity of the ship, the displacement, and the centre of buoyancy, *from the model*. We could hardly believe the evidence of our own organs of vision, when we read a grave announcement of this mode of finding the centre of gravity of the vessel; for it needs no more than a moment's reflection to show that the centre of gravity of a *real ship*—a body so heterogeneous, consisting of such various parts, and such various materials, with weights, and stores, and masts, must be in a very different position from the centre of gravity of a model formed of an uniform homogeneous piece of wood.

Nor can we look upon its use to determine

the displacement and centre of buoyancy, as anything better than a rough unphilosophical expedient. Indeed, our author seems to allow this, when he tells us, p. 30, "This additional weight will not be necessary for the navigation of our lakes, although the use of the hydrostatic balance is one of the most efficient and reliable modes of determining the amount of displacement from the model *unless by actual computation*, which exacts a tax of time to which few builders are willing to submit."

Now, when we consider the time which every vessel of any magnitude requires for its actual construction, when we reflect that the calculation of the stability, so important an element for its successfully combatting with the treacherous element to which it is to be entrusted, *must* be made from the draught, and requires a knowledge of the displacement and position of centre of buoyancy, it does seem strange that the builder should grudge the little additional time and labour which the calculation of these from the draught demands. Do the builders who make exclusive use of the model calculate the stability at all?—or do they not rather trust to the form of their vessels not deviating much from that of known stability? We cannot help suspecting that the transatlantic shipbuilders are not very expert in the use of draughts, and are but scantily instructed in anything which deserves the name of science in their profession. Another reason which Mr. Griffiths insists upon, as rendering the use of the model imperative and exclusive is, the impossibility of obtaining a correct idea of the form of a vessel from its draughts. The constructor, he tells us, must have the model complete before his eye, to obtain any idea of its qualities.

From this judgment we entirely dissent, and we have no doubt that all shipbuilders of any experience and success in their calling will give us their suffrages. A little experience would enable any man of discrimination to form a very sufficient idea of a vessel's form from the lines: they present him at once with sections in three directions—viz., length, breadth, and depth. Diagonals, too, or sections made as nearly as may be perpendicular to the surface, and on which Mr. Griffiths (so far not incorrectly) relies most for giving an idea of the vessel's form, can be readily laid down on his paper at whatever point he pleases in a very short time. We have no hesitation in saying, then, that the draughts give to the man of experience as accurate a notion of form as could be desired, and have the further advantage of furnishing him with the *only reliable basis* for the various calculations, without which no ship ought ever to be constructed. Should, however, a constructor be so minded, and imagine there is an advantage in having a model before his eye, let him have one made—but *supplementary* to, not a substitute for the lines. Never, we trust, will shipbuilders of this country fall into the empirical habit of *relying* upon the model, and sacrifice to their ease the only accurate, though laborious approximations to the various elements of construction. In fact the slovenly, loose habits, which this use of the model presupposes, are amply illustrated by our author's own mode of treating this subject, and, to our mind, present the most useful commentary on its value. Take the following specimens:—At page 25 we are told "we must distinguish between the effects of gravity and that of weight: gravity has no dependence upon the mass, while weight depends entirely upon it. For example, *in a vacuum*, or a reservoir from which the air has been extracted, a feather will obey the laws of gravity as easily as a lump of lead; and having been started from the top at the same time, would also reach the bottom at the same time. *But when exposed to the atmosphere, we find that by reason of the density of the lead, or the bulk of the matter it contains, or its excess of weight, that it falls much faster than the feather!*" Indeed, Mr. Griffiths, say you so? Does the removal of the air equalize or remove the quantity of matter or weight of the lead and

feather, while in the atmosphere they exercise their full effect? Suppose, on the contrary, that the air, like water, opposes a resistance to the motion of bodies through it, and that such resistance is proportional to the amount of surface which bodies present, would not this be a more satisfactory explanation of the phenomenon, by reason of the much greater surface presented by a feather, and therefore of resistance in proportion to its weight than an equal quantity of lead? How if the withdrawal of the air removes the *disturbing causes*, and leaves gravity or weight to produce its full effect, and therefore, by the third law of motion, obliges *all bodies* to pass through the same space in the same time?

Again; he tells us, "The centre of gravity is an imaginary *point* or AXIS!" Again, page 28, he says—"For the sake of convenience, we have assumed the model to have been made upon a scale of 32·5 of a foot, or when the foot is divided into inches, eighths, and sixteenths, it would be recognized as being five-sixteenths, or one-quarter and one-sixteenth. The reason for adopting this scale for the elucidation of this subject is simply because it divides the cubic foot into 64,000 cubes." Now that a cubic foot may be divided in 64,000 cubes, each representing a foot, the scale must be one-fortieth of a foot to a foot; and the scale of 32·5 of a foot neither agrees with this, nor is it recognized as being five-sixteenths of an inch. In a few pages after it is acknowledged that this is an erroneous scale. Why, then, not give the true. Approximations are very valuable when exactness cannot be attained; but no wise man—certainly no mathematician—would deliberately prefer a mere approximation, with all its chances of error, to an exact value, when the one is as accessible as the other. Our readers are, we imagine, by this time pretty well satisfied as to the intrinsic merits of Mr. Griffiths' work: in our succeeding remarks we shall, therefore, aim more at the elucidation of the questions in naval architecture that will come under our notice than at pointing out Mr. Griffiths' blunders. Should our remarks meet that gentleman's eye, we do not apprehend that they will penetrate that coat of mail with which self-conceit has evidently clothed him, while we think we have done enough towards putting our fellow-countrymen in possession of the intrinsic merits of his work.

(*To be continued.*)

ON THE CONSTRUCTION OF STEAM BOILERS AND THE CAUSES OF THEIR EXPLOSIONS. BY WM. FAIRBAIRN, ESQ., C.E., F.R.S.

[Being the substance of two Lectures delivered before the Leeds Mechanics' Institution.]

The modifications of the steam engine which have been adopted since its introduction by Watt—three quartesr of a century ago—have been very numerous and varied; and although the progression in its applications and improvements has been most rapid and wonderful, we are still undecided as to the best form of its construction. Sound principles scientifically applied, and the gradually-increasing excellence of our mechanical workshop, have enabled us to attain the great perfection which characterises the working parts of the modern steam engine. The steam engine itself may be regarded as a comparatively perfect machine, and I shall, therefore, confine my observations almost exclusively to that very important and necessary adjunct—*the boiler*—which is the source of its power. With this limitation a very wide field of inquiry is opened out, and in the earliest steps of the investigation we become perplexed with the endless variety of forms and constructions which at different periods have been adopted by engineers, and which have never, unfortunately, received the same judicious attention that was paid, as I have already remarked, to the steam engine. This is an anomalous and much to be regretted fact; for the boiler, being the source of the motive power, is undoubtedly one of the most important parts of the whole machine. Upon its proper proportions and arrangement for the generation of steam depends the economy and regularity with which the engine can be worked—and upon its strength and excellence of workmanship depends the safety of the lives and property of those who come in contact with it. Regarding the steam engine as one of the most active agents in the extension of our prosperity, and in the civilization of the world—and seeing how

it is mixed up with the daily duties and workings of society—the safety and efficiency of every part, more especially the *boiler*, are subjects of national importance; and I feel gratified by being called upon to lay before you such knowledge and experience on this subject—of deep interest—as I myself possess.

I propose to consider the boiler in *construction*, *management*, *security*, and *economy*.

1st. As to the construction.—Here I shall have to go a little into detail in order to show, in construction, the absolute necessity there exists for adhering to form and other considerations, essential in the practice of mechanical engineers, in effecting the maximum of strength with the minimum of material. In boilers this is the more important, as any increase in the thickness of the plates obstructs the transmission of heat, and exposes the rivets as well as the plates to injury on the side exposed to the action of the furnace.

It has generally been supposed that the rolling of boiler plate iron gives to the sheets greater tenacity in the direction of their length than in that of their breadth: this is, however, not correct; as a series of experiments which I made some years since fully proves that there is no difference in the tensile strength of boiler plates when torn asunder in the direction of the fibre, or across it. From five different sorts of iron, the following results were obtained:—

Description of Iron.	Mean breaking weight in tons in the direction of the fibre.	Mean breaking weight in tons across the fibre.
Yorkshire Plates	25·77	27·49
Yorkshire Plates	22·76	26·37
Derbyshire Plates	21·68	18·65
Shropshire Plates	22·82	22·00
Staffordshire Plates	19·56	21·01
Mean	22·51	23·10

From this, it appears that we may safely use iron plates in the construction of boilers in whatever direction may best suit the convenience of the maker. Next to the tenacity of the plates, comes the question of riveting, or the best and surest means of securing them together. On this part of the subject we have been widely astray, and it required some skill, and no inconsiderable attention in conducting the experiments, to convince the unreflecting portion of the public—and even some of our boiler-makers—that the riveted joints were not stronger than the plate itself. At first sight this would appear to be the case, but a moment's reflection will soon convince us to the contrary—as in punching holes along the edge of a plate it is obvious that the plate must be weakened to the extent of the sectional areas punched out, and that it is next to impossible, under the circumstances, to retain the same strength in the material after such diminution has been effected as existed in the previously solid plate. This was clearly demonstrated by a series of experiments which took place some years since, and in which the strength of almost every description of riveted joint was determined by tearing them directly asunder. The results obtained from these experiments were conclusive, as regards the relative strength of riveted joints and the solid plates. In two different kinds of joints—double and single riveted—the strengths were found to be, in the ratio of the plate, as the numbers 100, 70, and 56.

Assuming the strength of the plate to be	100
The strength of a double riveted joint would be, after allowing for the adhesion of the surfaces of the plate	70
And the strength of a single riveted joint	56

These proportions of the relative strengths of plates and joints may therefore in practice be safely taken as the standard value, in the construction of vessels required to be steam and water tight, and subjected to pressure varying from 10 lbs. to 100 lbs. on the square inch.

(*To be continued.*)

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 30, 1851.

FREDERICK R. ROBINSON, of Boston, United States. *For a new and useful sewing machine.* Patent dated February 7, 1851.

This machine differs from the generality of those hitherto devised, in which a continuous length of thread is employed to form a chain stitch, and is intended for producing the descriptions of sewing known as "stitching," in all its varieties. The thread also si used in short lengths, such as would be employed for hand sewing.

Claims.—1. The employment of two needles, two thread-carriers, and the method of operating them in combination with the cloth-carrier.

2. Making the needles with spring eyes.

JOHN HAMILTON, of Princes-square, Glasgow, and JOHN WEEMS, of Johnstone. *For improvements in warming and ventilating buildings and structures.* Patent dated November 25, 1850.

Claims.—1. The warming and ventilating of buildings and other structures by means of a current of pure air, caused to pass by

suitable mechanical means, (such as a blower or fan) over surfaces heated by steam from a boiler, or by the waste or exhaust steam of a high-pressure engine employed to give motion to such fan.

2. A peculiar arrangement of heating apparatus, in which an external case or receptacle is employed, and the air caused to travel backwards and forwards over the surfaces thereof. Also the employment in such heating apparatus of India-rubber packings.

3. The warming and ventilating of steam and other ships and vessels by means of a current of pure warm or cold air produced by suitable mechanical means.

James Bendall, Woodbridge. *For improvements in certain agricultural implements.* Patent dated November 23, 1850.

The improvements claimed under this patent comprehend,

1. The adaptation to skim ploughs, scarifiers, and such like implements for tilling land, of an arrangement for raising and lowering the frame which carries the shares or coulters, and regulating the depth to which they are to enter the ground by means of a segment-piece, levers, and rod.

2. A method of attaching the wheels to such implements by means of collars and brushes of white or chilled iron.

3. An arrangement of the leading wheel, in such manner as to render it capable of adjustment vertically.

4. Making the tips of the coulters or shares removeable and renewable at pleasure.

5. A mill for crushing and bruising beans, peas, barley, &c. The substances to be operated on first pass between a pair of serrated rollers set at any required distance apart, and revolving in opposite directions at different rates of speed, and thence between a third roller also toothed, and a toothed plate, where they may be reduced to any required degree of comminution.

6. A machine for cutting turnips and other similar vegetables. The knives in this machine (two in number) are attached with their edges in opposite directions to the sides of a cone revolving in a case, to which are attached stops for the vegetables to rest against during the time of cutting. The vegetables, when cut fall through the cone into any suitable receptacle placed underneath.

7. A method of making the coulters of a mixture of steel and cast-iron to render them more durable.

Christopher Nickels, of York-road, Lambeth, gentleman. *For improvements in the manufacture of woollen and other fabrics.* Patent dated November 23, 1850.

Claims.—1. The felting or fulling of fabrics woven or made with raised pile, whether terry or cut pile.

2. The causing of double fabrics to be felted.

3. The causing of double ribbed looped fabrics to be felted.

4. The manufacture of Brussels carpeting and other terry weavings, by employing an additional permanent weft to form, uphold, and fill the terry loops.

5. A method of introducing transverse threads or yarns into warp fabrics, so as to produce a transverse corded appearance on the face of such fabrics.

6. The manufacture of double piled fabrics by employing printed or parti-coloured warp.

George Shepherd, of Holborn-bars, civil engineer, and Charles Button, operative chemist. *For certain improvements in the means or appliances used in conveying telegraphic intelligence between different places.* Patent dated November 23, 1850.

These improvements have relation to submarine electric telegraphs, and comprehend,

1. A method of saturating flannel or other suitable fabric with certain chemical compositions (in which white and red lead, gutta percha, creosote, and boiled oil are among the ingredients employed), and using this saturated flannel for wrapping around a strand of gutta percha containing the insulated wires, and finally enveloping the whole with metal or metal wire, either plaited, laid, or coiled around the said strand so wrapped in saturated flannel.

2. Protecting the insulated wires by laying them in the angular spaces formed by the junction of the links of a chain, whether such chain be composed of links round or oval, or of bars of iron bolted or shackled together.

3. A peculiar construction of clamp for attaching the wires to the chains.

4. Attaching the wires to a rope or flexible band, not being a chain.

5. A testing apparatus to be attached to the submerged line of wires for indicating any defect therein.

6. The employment of floating signal buoys, and of immersed buoys attached to the line of wires horizontally between the testing apparatuses, and vertically between the testing apparatuses and the signal buoys.

7. A peculiar form or forms of casing for protecting the wires on their arrival at the sea-shore, the parts of such casing being united by horizontal and vertical flanges and bolts.

8. A method or methods of securing the wires of the electro-marine line on the sea-

shore by bolting the casing containing the same either to the rocks or to piles sunk in the shore.

WEEKLY LIST OF NEW ENGLISH PATENTS.

George Tate, of Bawtry, York, gentleman, for improvements in the construction of dwelling-houses and other buildings, including floating vessels, and for the adaptation and manufacture of materials for such uses. May 22; six months.

Benjamin Bailey, of Leicester, for improvements in the manufacture of looped fabrics. May 23; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in the carbonization of coal, and in the utilization of the products disengaged during that operation, in improving the quality of the products intended for illuminating purposes, and in regulating of the same. (Being a communication.) May 27; six months.

Archibald Slate, of Woodside Ironworks, Worcester, for improvements in steam engines and steam boilers, and in the passages and valves for the induction, eduction, and working of fluids. May 27; six months.

John Fielding Empson, of Birmingham, for improvements in the manufacture of buttons. May 27; six months.

John Harrison, of Blackburn, Lancaster, for certain improvements in the manufacture of textile fabrics, and in the preparation of yarns or threads for weaving. May 27; six months.

A grant of an extension unto James Potter, of Manchester, Lancaster, cotton spinner, for the term of five years, from the 21st December, 1850, for his invention of certain improvements in spinning machinery.

William Crane Wilkins, of Long-acre, Middlesex, engineer, for certain improvements in railway buffers. May 29; six months.

Joseph Reynolds, of Vere street, Middlesex, card maker, for improvements in the manufacture of cards usually denominated playing cards. May 29; six months.

John Pegg, of Leicester, manufacturer, for improvements in producing corrugated surfaces and leather. May 29; six months.

Henry W. Adams, of Boston, Suffolk, Massachusetts, United States of America, for an improved means of generating galvanic electricity, of decomposing water or various electrolytes, of collecting hydrogen, of burning it, or atmospheric air, separately or in combination. May 29; six months.

Robert William Sievier, of Upper Holloway, Middlesex, civil engineer, for improvements in weaving and printing textile fabrics. May 29; six months.

John Ashworth, of Bristol, manager of the Great Western Cotton Works, for certain improvements in the method of preventing and removing incrustation in steam boilers and steam generators. May 29; six months.

LIST OF SCOTCH PATENTS FROM 22ND OF APRIL TO THE 22ND OF MAY, 1851.

Thomas Haimes and John Webster Hancock, of Melbourne, Derby, manufacturers, and Albert Thornton, of Leicester, mechanic, for improvements in the manufacture of knit and looped fabrics, and for raising pile thereon. April 28; six months.

Gaetan Kossovitch, of Middleton-square, Middlesex, gentleman, for improvements in rotary steam engines. April 29; six months.

John Borland, of Norfolk-street, Strand, Middlesex, engineer, for certain improvements in weaving machinery. April 29; six months.

Edmund Morewood, of Enfield, Middlesex, gentleman, and George Rogers, of the same place, gentleman, for improvements in the manufacture of metals, and in coating or covering metals. April 30; six months.

Hugh Barclay, of Regent-street, Middlesex, for improvements in the means of extracting or separating fatty and oily matters, in refining and bleaching fatty matters and oils, animal and vegetable, wax and resins, and in the manufacture of candles and soap. April 30; six months.

Thomas Beale Browne, Hampen, near Andoversford, Gloucester, gentleman, for improvements in weaving and preparing fibrous materials, and staining or printing fabrics. (Being a communication.) May 1; six months.

Samuel Jacobs, of Highgate, Kendal, Westmoreland, cabinet-maker, for certain improvements in printing on woollen, cotton, paper, and other substances, parts of which improvements are applicable also to the purposes of colouring, shading, tinting, or varnishing such substances. May 2; four months.

Charles Iles, of Bordesley Works, Birmingham, Warwick, machinist, for improvements in manufacturing picture frames, inkstands, and other articles in dies or moulds, also in producing ornamental surfaces. May 5; six months.

John Alexander Lerow, of Boston, America, gentleman, for certain improvements in sewing machines. May 9; four months.

François Marcelin Aristide Dumont, of Paris, engineer, for improved means, and electric apparatus for transmitting intelligence. May 9; four months.

Henry Wimshurst, of Limehouse, Middlesex, shipbuilder, for improvements in steam engines, in propelling, and in the construction of ships and vessels. May 12; six months.

Henry W. Adams, of Boston, and State of Massachusetts, North America, for an improved means of generating galvanic electricity, of decomposing water or various electrolytes, of collecting hydrogen, of burning it or atmospheric air separately, or in combination. May 14; four months.

LIST OF IRISH PATENTS FROM 21ST OF MARCH TO THE 19TH OF MAY, 1851.

William Hodgson Gratrix, of Salford, Lancaster, engineer, for improvements in the method of producing or manufacturing velvets, or other piled fabrics. March 20.

William Stones, of Queenhithe, London, stationer, for improvements in the manufacture of safety paper for bankers' cheques, bills of exchange, and other like purposes. March 25.

John Ransom St. John, of New York, America, engineer, for improvements in the process of, and apparatus for manufacturing soap. March 28.

Frederick Watson, of Moss-lane, Hulme, Manchester, Lancaster, gentleman, for improvements in sails, riggings, and ships fittings, and machinery and apparatus employed therein. March 28.

Herbert Taylor, of 46, Cross-street, Finsbury, Middlesex, merchant, for certain improvements in the manufacture of carbonates and oxides of barytes and strontia, sulphur and sulphuric acid, from the sulphates of barytes or strontia, and for consequent improvements in the manufacture of carbonates and oxides of soda and potassa. April 2.

George Shepherd, of Holborn-bars, civil engineer, and Charles Button, of the same place, operative chemist, for certain improvements in the means or appliances used in conveying telegraphic intelligence between different places. April 15.

Gaetan Kossovitch, of Middleton-square, Middle-

sex, gentleman, for improvements in rotary steam engines. (Being a communication.) May 2.

Henry Crosley, of the Grove, Camberwell, Surrey, engineer, for certain improvements in the mode or modes, method or methods, of manufacturing raw sugar from beet-roots, and in preparing such roots for that purpose, and in obtaining saccharine matter from such roots when prepared, or in a raw state, and in the machinery or apparatus, and a combination or combinations thereof, applicable for that purpose, part of which modes or methods, and also part of the machinery and apparatus, with certain adjuncts and combinations, are applicable to the refining of beet and other sugar, and for other useful and manufacturing purposes. May 6.

John Gwynne, of Lansdowne Lodge, Notting-hill, Middlesex, merchant, for improvements in machinery for pumping, forcing, and exhausting of steam, fluids, and gases, and in the adaptation thereof to producing motion, to the saturation, separating, and decomposition of substances. May 16.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
May 22	2823	B. Hick and Son	Bolton	Combined steam generator, or steam-engine boiler.
23	2824	A. Lamb and J. White.	Southampton	Life-boat.
„	2825	W. Haigh	Huddersfield	Cow-milker.
„	2826	Miller and Sons	Piccadilly	Railway lamp.
24	2827	J. Gray and Son	Edinburgh	Radiating and reflecting-shell stove.
26	2828	F. W. Exall J. S. Harraway	Walworth Common New-cross, Old Kent-road	Spring handle cricket-bat.
27	2829	G. Young	Glasgow	Adjustible screw-key wrench, or spanner.
28	2830	S. Jackson	Red Lion-street	Illuminated candle clock.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

May 23	217	E. Stone	Wellington-place, Margate	Portable revolving dust separator and stove-cleaners' companion.
24	218	J. Bevan	Lyndhurst-place, Deptford	Shirt.
26	219	W. Riddle	East Temple Chambers, White-friars	Corkscrew and wire-nippers.
„	220	W. Riddle	East Temple Chambers, White-friars	Handle to lid of metal jug.
„	221	W. Riddle	East Temple Chambers, White-friars	Shower-bath.
„	222	W. Riddle	East Temple Chambers, White-friars	Apparatus for heating curling-irons by gas.
„	223	W. Riddle	East Temple Chambers, White-friars	Suspensory hospital couch.
„	224	W. Riddle	East Temple Chambers, White-friars	Looking-glass stand.
„	225	W. Riddle	East Temple Chambers, White-friars	Reading easel.
„	226	W. Riddle	East Temple Chambers, White-friars	Jar to be closed, sealed by mercury.
„	227	W. Riddle	East Temple Chambers, White-friars	Can for the conveyance of milk by railway.

The Great Exhibition.—We wait the appearance of Part II. of the Official, Descriptive, and Illustrated Catalogue (announced for the 1st of June) before resuming our own survey.

CONTENTS OF THIS NUMBER.

Specification of Mr. Rock's Patent Improvements in Carriages (*with engravings*) 421
Fincham's History of Naval Architecture—Mr. Fincham in reply to Dr. Woolley 423
On the Publication of Patented Inventions. By M. S. B. 426
Mr. Frost's "Stame," Report of, further Experiments by Mr. Frost........................... 428
The First Idea of the Electric Telegraph 429
Description of Mr. James Nasmyth's Absolute Safety Valve (*with engravings*) 430
Naval Architecture: White and Griffiths' Treatises (Review continued)..................... 431
On the Construction of Steam Boilers, and the Causes of their Explosions. By William Fairbairn, Esq., C. E., F.R.S....................... 436
Specifications of English Patents Enrolled during the Week:
Robinson ....Sewing Machine 437
Hamilton & Weems..Warming and Ventilating 437
Bendall ....Agricultural Implements..................... 438
Nickels ....Fabrics 438
Shepherd & Button...Submarine Telegraphs 438
Weekly List of New English Patents 439
Monthly List of Scotch Patents..................... 439
Monthly List of Irish Patents 439
Weekly List of Designs for Articles of Utility Registered 440
Weekly List of Provisional Registrations 440

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DUCKWORTH'S PATENT CHICORY MACHINE.

Fig. 1.

DUCKWORTH'S PATENT CHICORY MACHINE.

(Patent dated November 14, 1850. Specification enrolled May 14, 1851.)

Specification.

My improvements in the manufacture of chicory consist; first, in preparing the same for grinding by a combination of roasting and steaming processes, or by roasting alone in improved roasting machinery; and second, in moulding and compressing the chicory so prepared (or otherwise) into pieces of the shape of berries and other arbitrary forms, whereby it may be preserved for use unimpaired for a great length of time.

The arrangements necessary for carrying the first of these improvements into effect are represented in figs. 1, 2, 3, and 4 of the engravings annexed; fig. 1 being an end elevation partly in section, fig. 2 a longitudinal section, fig. 3 a plan, and fig. 4 another end elevation of an apparatus constructed for this purpose. A is the furnace or fireplace; B the ashpit; C^1, C^2, D^1, D^2, D^3, and D^4 a set of roasting cylinders, which are made of solid or plate metal, and so fixed over the furnace that there is free space left for the heated vapours and flame from the fire to circulate about them before passing off into the chimney. Each of these roasting cylinders contains within it an endless screw F, the spindle of which has its bearings in the ends of the cylinder (see fig. 2); each spindle carries at its outer end a spur wheel G, and the entire series of spur wheels gear one into the other, so that when one endless screw is made to revolve by a driving band from the pulley H, all the others must revolve simultaneously. The chicory, cut in pieces as is commonly sold in the market, is fed into the hopper I. From this hopper the pieces of chicory drop into the roasting cylinder D^1, and are impelled forward to the opposite end by the action of the endless screw of that cylinder, whence they pass through an opening into the second cylinder D^2, through which they are impelled in like manner, but in a contrary direction, till they drop into the third roasting cylinder D^3; after being impelled through which, in the same way, they are transferred into a cylinder K, in order to be steamed, whereby the chicory will be almost entirely deprived of its earthy flavour. This steaming cylinder is of the same form as the roasting cylinders just described, and, like them, contains an endless screw for causing a gradual propulsion of the chicory from one end to the other—only that, instead of being made of solid or plate metal, it is formed of wire cloth or perforated metal, and is enclosed in an external casing kept filled with steam supplied from some conveniently-placed steam generator. The steaming cylinder, with the top of the steam case removed, is shown in the plan fig. 3. The chicory, having been made to traverse through the steaming cylinder, falls at the further end of that cylinder into a short inclined cylinder L, in which there is an endless screw kept revolving by means of the bevel gear MM. By this screw the chicory is raised up into the last of the roasting cylinders D^4, after being impelled through which, it is discharged from the spout N in a thoroughly dry and roasted state. When the chicory does not require to be steamed, then it is either at once discharged from the cylinder D^3, or transferred directly into the cylinder D^4.

Of course it will be readily understood that the speed given to the endless screws must be regulated by the operator according to the length of the cylinders and the intensity of the heat in the furnace.

C^1 and C^2 are two supplementary roasting cylinders quite detached from the others, and unconnected with any steaming cylinder, which may be used either for the purpose of giving additional roasting to chicory which has gone through the process just described, but not been sufficiently desiccated, or may be used by themselves to roast chicory which requires no steaming. These supplementary cylinders are connected together in the same manner as the cylinders D^1, D^2, D^3, and D^4, and are furnished, like them, with endless propelling screws. O is the hopper by which they are supplied, and P the spout from which the roasted material is discharged from the second cylinder C^2. Instead of the screws revolving alone, the cylinders may be made to revolve along with them, or the screws may be made stationary, and the cylinders alone made to revolve.

The apparatus for carrying the second of my improvements into effect; namely, the moulding or compressing the chicory into pieces of the shape of berries, and other arbitrary forms, is represented in figs. 5 and 6. Fig. 5 being an elevation of a mill such as is generally employed for grinding chicory. Fig. 6 an end elevation of the forming or moulding apparatus necessary to be added thereto, and fig. 7 a plan of the forming apparatus alone. A is the hopper; B B the mill-stone cas and CC the framing of B B, beneath which the forming apparatus is placed, so that as the ground chicory issues from the spout of the mill it may fall directly into the forming rollers to be presently hereafter described. The ground chicory as it comes from the mill is usually in a warm and soft state, and easily capable of being compressed into any form desired to be given to it. D D are two

side frames, into which the bearings of the two forming rollers E E are placed. These rollers have numerous cavities sunk in their surfaces of the particular form intended to be given to the chicory; F F are a pair of spur wheels which are keyed upon the ends of the spindles of the forming rollers, and by gearing into each other, cause the rollers to revolve uniformly and together. G is another wheel which is keyed upon the opposite end of one of the roller spindles, and is geared into by a pinion H, which is affixed to the shaft J.

Fig. 3.

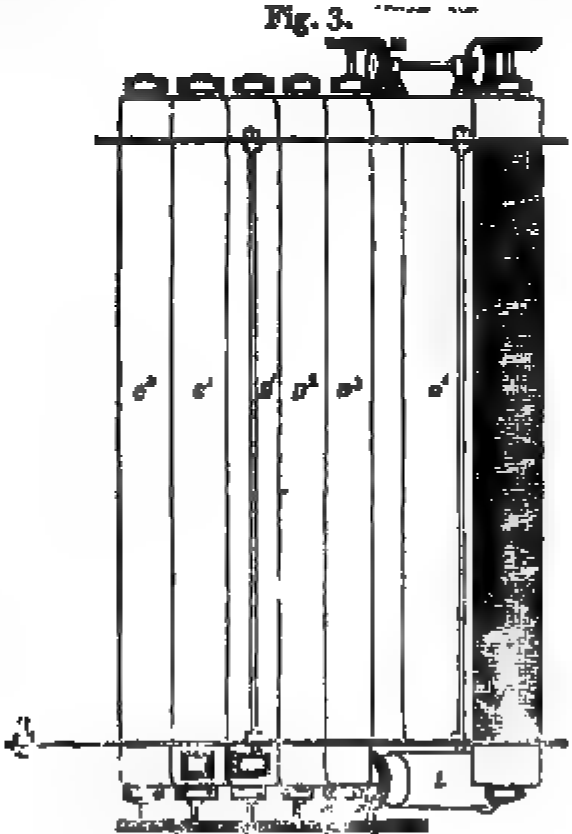


Fig. 7.

Fig. 4.

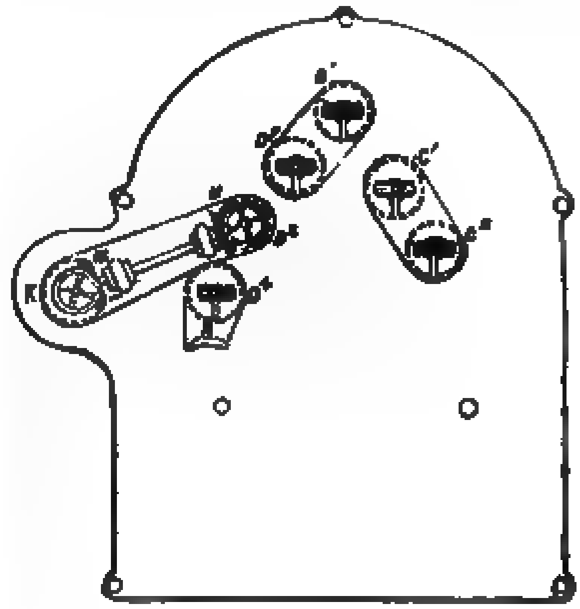


Fig. 5.

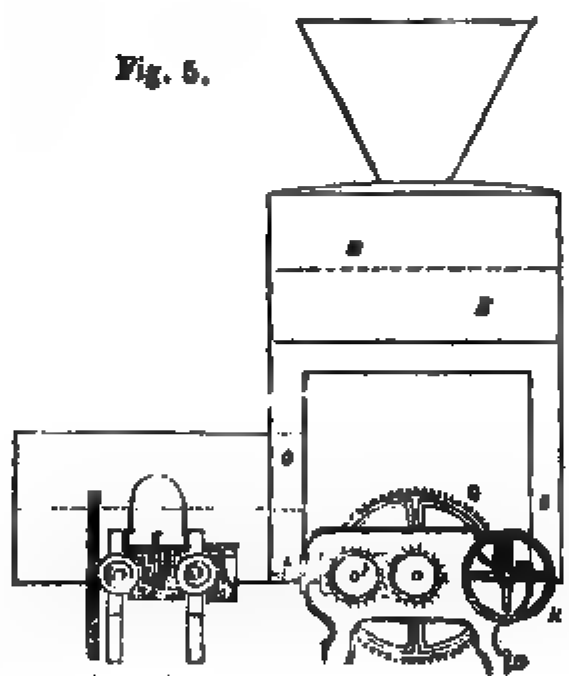


Fig. 6.

KK are the driving pulleys, by which motion is given to the different rollers from a steam-engine or other prime moving power. L L are pinching screws by which the rollers are kept in close contact, and their pressure against each other adjusted to the degree proper for compressing the chicory. After passing between the rollers, the chicory falls, in the form of berries or whatever other form it may seem proper to give to it, into a receiver placed below the machine. I prefer giving to the ground chicory the form of a berry or some rounded figure, in order that it may be the more readily disengaged from the moulds or hollows in the rollers. The chicory, after it has been subjected to the pressure requisite for imparting such forms to it, is besides greatly improved thereby in quality, inasmuch as a hard and glossy surface is thus given to it, which renders it little susceptible of injury from atmospheric influence, and therefore enables it to be kept unimpaired for a great length of time.

Either raw or roasted chicory in an unground state may be sent through the forming or moulding machine which has just been described in reference to the ground chicory, but in

either of these cases a greater power is necessary to drive the machine than when the chicory is previously ground. It may happen occasionally that the ground chicory will come from the mill in too dry a state for moulding; and when that is the case, which the workmen in attendance on the operation will readily ascertain from inspection, it must be slightly damped either by means of steam or water.

And having now described the nature of my said invention, and in what manner the same is to be performed, I declare that the improvements which I claim as of my invention are as follows:

First, I claim the preparing of chicory for grinding by a combination of roasting and steaming processes, as before described; and also the machinery or apparatus for that purpose, in the peculiar arrangement, disposition, and embodiment of parts of which the same consists, as before described.

Second, I claim the improved machinery or apparatus for roasting chicory. And,

Third, I claim the forming, moulding, or compression of chicory into pieces of the shape of berries or other arbitrary forms, as before described, and the use of figured rollers for the purpose, as before described.

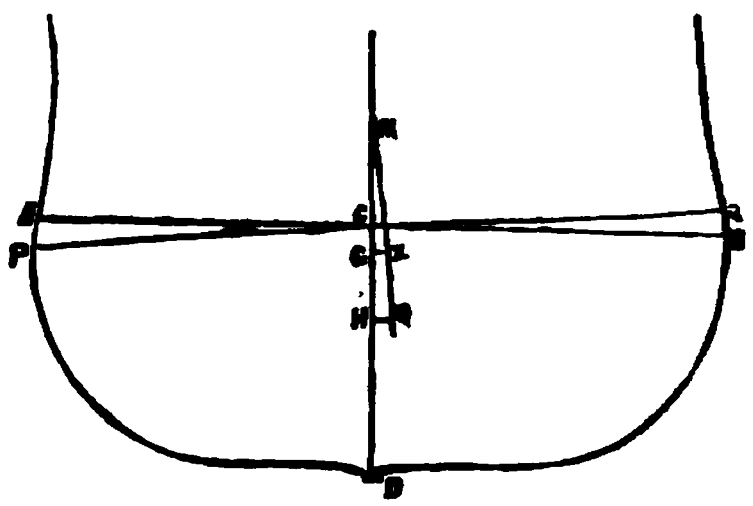
NAVAL ARCHITECTURE.—WHITE AND GRIFFITHS' TREATISES.

(Review, continued from p. 436.)

We propose now to examine the present state of the question of *stability*, to the elucidation of which the principles of mathematics have been applied with more success than to any question in naval architecture.

It has been stated above, that in order that a solid may float in equilibrio on a fluid, two conditions are necessary:—1. That the weight of the solid be equal to the weight of the displaced fluid; and 2. That the line joining their centres of gravity be vertical.

These, however, are not all the conditions that are necessary for a *permanent* state of equilibrium. It is evident that if the body be displaced from the position of equilibrium, by being made to revolve through an angle, the whole volume of the fluid displaced being unaltered, the *form* of the displacement, and therefore the position of the centre of buoyancy, generally changes, and the straight line joining the centre of gravity of the body, and the centre of buoyancy, is no longer vertical; hence motion must ensue. This motion may be *towards* the original position of equilibrium, or *from it*, or in exceptional cases there may be no tendency to move either way, but the body remain in the position which it is made to assume. In the first of these cases, it is said to be in a position of stable; in the second, of unstable; and in the third, of neutral equilibrium. In the annexed figure, let ADB be a vertical section of the floating body, containing G its centre of gravity, and H the centre of buoyancy. Let AB be the section of the water-line when floating upright, and therefore CGHD the line joining C and D



vertical. Let now the vessel be inclined through a very small angle, so that PQ is the section of the inclined water-line, and let ACP $=\theta$. Let QM be a vertical line through the centre of buoyancy in the inclined position—*i. e.*, the centre of gravity of the volume PDBQ; then it is proved that ACB, PCQ intersect in the point C, C being the middle point of AB; and that the horizontal line through C, perpendicular to the section ADB passes through the centre of gravity of the load-water line AB; also that M being the point where the vertical QM cuts AB, when the angle θ is indefinitely small

$$HM = \frac{k^2 A}{V},$$

where k^2A is the moment of inertia of the

load-water line about the horizontal axis through C and V is the volume of the immersed portion ADB. M, the point in which the vertical through the inclined centre of buoyancy *ultimately* intersects the straight line joining the centres of gravity and buoyancy in the upright position, is called the *metacentre*. If HG, the distance between the centres $= d$, then

$$GM = \frac{k^2 A}{V} - d.$$

Through G draw GZ perpendicular on QM; then in the inclined position we have evidently the weight of the body acting vertically downwards through G, and the resultant fluid pressure which (since the immersed volume is supposed to be of the same magnitude as before) equals the weight of the vessel acting vertically upwards through M. Hence

$$W.GZ = W\left\{\frac{k^2 A}{V} - d\right) \sin. \theta.$$

$$\lambda = W\left\{\frac{\mu k^2 A}{W} - d\right) \sin. \theta.$$

$$= (\mu k^2 A - Wd) \sin. \theta.$$

(where $\mu =$ weight of a cubic foot of water), measures the moment of the couple, which tends to turn the vessel about a horizontal axis through G. It is evident that this couple will tend to bring the body back to its original position, to leave it at rest, or incline it still further, according as the point M is *above*, *on*, or *below* G, *i.e.*, as $\mu k^2 A$ is greater, equal to, or less than Wd.

It is evident that in different vessels, the greater the distance GM, the greater is GZ, the arm of the couple, which measures the tendency of the body to return to its vertical position. Hence Euler, and most foreign writers on this subject after him, take GZ as the standard of comparison of the stability of various vessels.

In this theorem M is the point of *ultimate* intersection of the vertical through the inclined centre of buoyancy and the vertical CGH. Euler considered that when the vessel inclined through a *finite angle* θ (within the limits that vessels are usually kept inclined by the action of a steady wind), the points in which the verticals through the successive centres of buoyancy will intersect CD, will not materially differ from M, and that $GZ = GM \sin. \theta$ may in all cases be taken for the arm of the couple; $\therefore$ $W.GZ = (\mu k^2 A - Wd) \sin. \theta$, may in all cases be taken as a measure of the *stability*. It is evident that this is only an approximation; and although in vessels of the usual form it will not differ very materially from the true value, yet we might easily give a vessel such a form about the water-line as to make it very erroneous. We may say one word as to the mode of calculating $\mu k^2 A$.

Thirty-five cubic feet of *sea water* weigh about one ton, and as it is usual to measure displacement and stability in tons, we must put for μ its value, $\frac{1}{35}$th of a ton. Again, $k^2 A$ is the moment of inertia of the load-water line

$$= \frac{2}{3}\int y^3 dx,$$

where y is the ordinate drawn parallel to the breadth of the ship at the distance x from the middle point ϕ. As the load-water line is not generally a regular curve, Simpson's rule must be applied to obtain its value. To do this, let the length of the load-water line be divided into an equal number of portions fore and aft from the middle point ϕ; let ordinates be drawn through the extremities of these intervals, and their cubes taken and treated as ordinates of a second curve at the same equal intervals. Then if $A =$ sum of first and last ordinates, $P =$ sum of the even, and $Q =$ sum of all the odd ordinates except the first and last; and $m =$ interval between the ordinate

$$\frac{2}{3}\int y^3 dx$$

$$= \frac{2}{3}(A + 4P + 2Q)\frac{m}{3},$$

$$= \frac{2m}{9}(A + 4P + 2Q);$$

and this being found for the portions of the water-line on each side ϕ; their sum $= k^2 A$.

We have not given the investigation of this theorem, as it is well known.

It has however been assumed, that the volume of the water displaced does not change in *amount* while the vessel inclines over this or any angle: let us consder what reason there is for this assumption. It is evident, that when the vessel inclines, *at first* it must *begin* to move about a horizontal axis through G. Suppose it then to be so moving, it is evident, that *in general*, when it has passed through a *very small* angle round this axis, a larger volume will be *carried under water* by the inclination on the immersed side, than is carried out on the emersed side. The whole volume of the body immersed is therefore increased, and the resultant fluid pressure is therefore increased. Now, the *very instant* that the resultant fluid pressure becomes greater than W, the weight of the vessel, *by ever so small an amount*, we have a resultant force on G, the centre of gravity of the vessel acting upwards, which being unopposed, will move the centre of gravity *vertically upwards*, until by this motion the equality of the resultant fluid pressure and the weight of the vessel is restored. The axis through the centre of gravity, therefore, is no longer the *instantaneous* axis which shifts its position; and as by the rotation of the vessel round the successive *instantaneous axes*, the same effect is usually produced; the centre of gravity will evidently continually rise until the extreme inclination is attained. It is possible to conceive a form of vessel, so that the centre of gravity should *fall*, instead of rising, by reason of the wedges carried under water at successive small inclinations, being *less* than the wedges carried out of water. This is not however the general case; and we shall suppose that in passing through successive small angles from the upright position, the centre of gravity *rises*. It is then evident, that we are not correct in supposing an exact equality between the resultant water-pressure and the vessel's weight. What then is the amount of the difference? Practically so small as to be inappreciable. This motion of the centre of gravity of the vessel is evidently analogous to what takes place at the opening of a *safety-valve* in a steam-boiler: as soon as the steam-pressure in the boiler per square inch exceeds, by *ever so small an amount*, the load per square inch on the one side of the valve, that very instant it opens. The difference of pressures on the two sides, however, is so small, that it bears no appreciable ratio to either of them. Those of our readers who are familiar with D. Pambour's admirable theory of the Steam Engine, will not fail to observe an analogy between the motion of the centre of gravity of the ship, and that of the piston which begins to ascend immediately the pressure of the steam in the cylinder exceeds *in the slightest degree* the resistance opposed to its motion; so that at any point of the stroke, supposing steam admitted throughout the whole stroke, the steam pressure may be considered equal to the resistance.

In a manner exactly analogous the centre of gravity of the vessel during the inclination will rise, and *may rise through a very appreciable space*; while yet, at every instant, the resultant pressure of the fluid will differ from the weight of the vessel *by an inappreciably small magnitude*, and may be supposed *equal to it*.

In this supposition we neglect the *increased* pressure arising from the *impact* of the side of the vessel against the fluid, and also any resultant pressure that may arise in a *horizontal direction*: they will in general bear no proportion to the whole fluid pressure and their effects may be neglected. Hence, it is evident that as a vessel inclines from the upright position, from whatever cause, whether the action of the wind on the sails, or the blows of waves, its centre of gravity will rise in a *vertical line*: and of course, if it be allowed to regain its upright position, in doing so the centre of *gravity will fall*: and yet all the while the whole volume of the part of the vessel immersed may be considered invariable. We recommend to the careful consideration of students of naval architecture these observations on the motion of the centre of gravity of the vessel; as they will

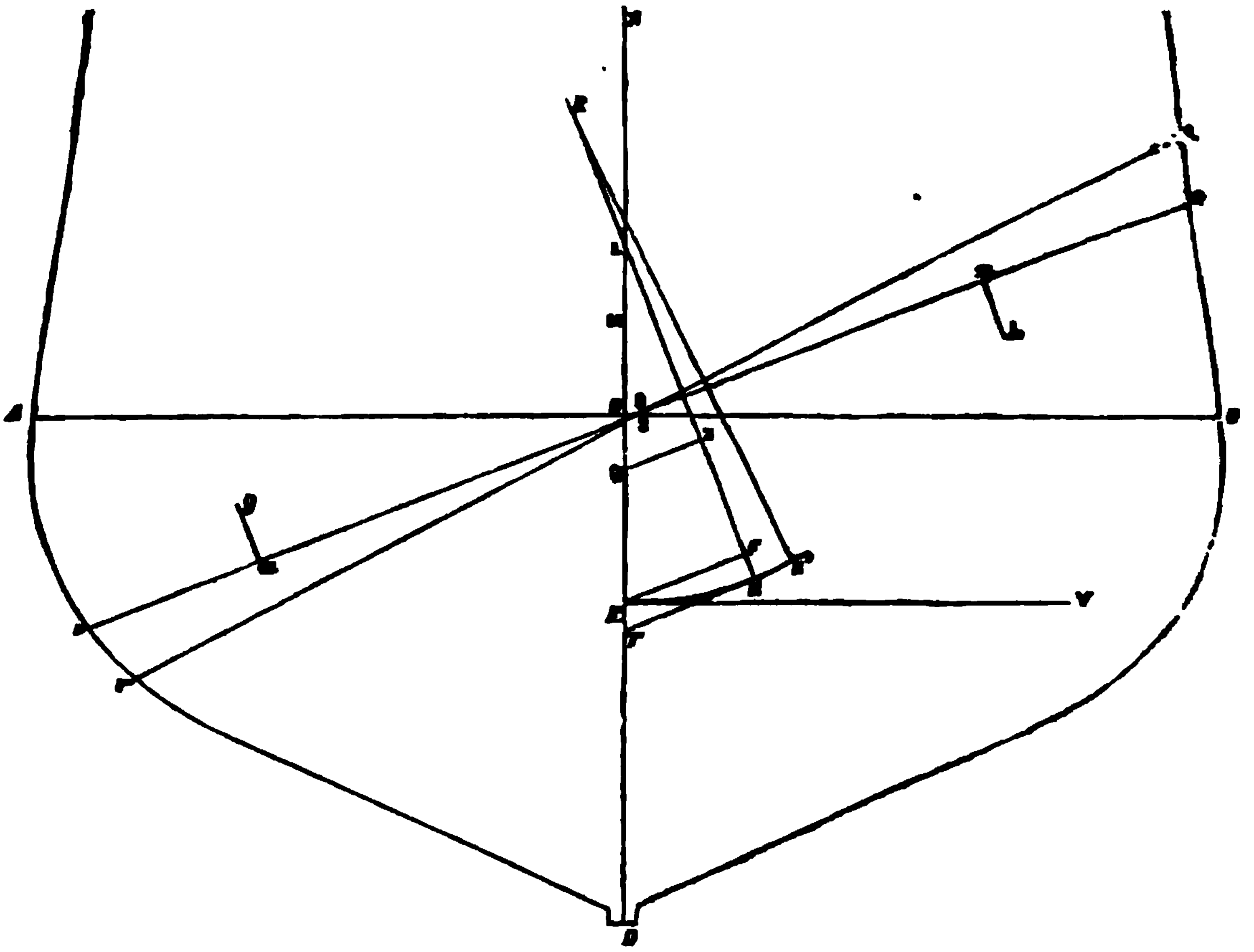
tend to remove much of the difficulty which this question generally presents; and prevent the confusion of ideas which often prevails on it. So little has this been noted by most writers on this subject, that in a Memoir of the Rev. Professor Moseley on the Dynamical Stability of Ships, published in the "Philosophical Transactions" for 1850; he observes, in a note, "It is remarkable what currency has been given to the error, that whilst a vessel is rolling or pitching, its centre of gravity remains at rest."

Amongst practical men this error may be current; but we cannot allow that it is shared by those who have considered the matter in a scientific point of view; and we suspect that had he put the question to any of the intelligent and excellent shipwright officers who were educated at the late School of Naval Architecture, he would have been undeceived. In Dr. Inman's little work "On Formulæ and Rules for making Calculations on Plans of Ships," published in 1849, which does not profess to treat of the mechanical laws which regulate the motion of floating bodies, page 13, article xlv., he says:—"To maintain the same displacement, a ship in inclining usually *rises bodily*, and in righting *falls to its first level.*"

The fact is here plainly stated, and we imagine is well understood by all who had the benefit of the Doctor's training in the School of Naval Architecture. We do not for a moment imagine that Professor Moseley wished to do an injustice to Dr. Inman and his pupils; but we have thought it only fair and right to take this opportunity of convincing the world that they at least have never given currency to this error.

In truth, among writers both at home and on the Continent, it has been too much the habit to limit their inquiries to what takes place at the *beginning* of the motion while vessels roll or pitch; and as at the beginning the vessel undoubtedly does move, though in general for an inappreciably short time, about an axis through the centre of gravity, their statements on this point have been received in too absolute a sense; and hence probably the error has arisen of which Professor Moseley complains.

The discovery of the metacentre, and its application to the stability of ships, we owe to M. Bouguer, an eminent French engineer of the middle of the last century. Perceiving that the metacentre was applicable only to the case of a vessel rolling through an infinitesimally small angle, his *geometric sense*, if we may so speak, led him to a false analogy, which was ably exposed by Mr. Attwood. He conceived that, as the metacentre was the point of intersection of two consecutive normals to the curve traced out by the successive positions of the centre of buoyancy, when one of those normals was the vertical line drawn through the centre of gravity of the ship and of the displacement in the upright position, that points similarly obtained for every other inclination of the vessel would possess similar properties with respect to the stability as the metacentre. These points are all arranged in a curve, which he named the metacentric curve, and which is evidently the evolute to the curve traced out by the centre of buoyancy. The distance of any point in this curve from the corresponding centre of buoyancy, by a mode of reasoning precisely analogous to that employed in finding the metacentre, is readily seen to be equal to the moment of inertia of the inclined water line divided by the displacement. As many points in it, therefore, as might be required, would readily be obtained by purely geometrical calculations. In the annexed figure let ADB represent the section by a vertical plane through the ship's centre of gravity of the part immersed in the upright position, and PDQ the section of the displacement when the vessel has heeled through the angle ASP. EHH′ the locus of the centres of buoyancy, HR, H′R two consecutive normals, H corresponding to the water line PQ: then R is the corresponding point in the metacentric curve. Bouguer *assumes* that if G, the centre of gravity of ship, and R be joined, $W \times GR$ is a measure of the ship's stability at the inclination ASP from the upright, as $W \times G\mu$ is when the inclination is evanescent. For this no *mechanical* reason can be given. The properties of the curve



EHH′, however, can readily be applied to determining the amount of the moment of stability at any angle of inclination. It is easily shown that the tangent to this curve at any point is parallel to the corresponding water line. Hence the normal HR must be vertical, and therefore represents the line of application of the fluid pressure at this angle. Through G then draw GZ perpendicular on HR, and let L be the point where HR cuts the line CD; then GZ = GL sin GLZ = GL sin ASP, and the moment of stability = W × GZ = W. GL sin ASP. We have ourselves applied this formula with success to the determination of the stability of many vessels of the forms discussed by Attwood. This curve also, it appears to us, may be employed with advantage in setting the whole question of stability in a clear light before students.

Professor Moseley, in the memoir to which we have already referred, proposes to subject the stability of a vessel to a new measure, to which he gives the name of dynamical stability. Its object is to determine the extreme angle to which a vessel subjected to any sudden gust of wind, or blow of a wave, or other disturbing cause, will roll; which evidently much exceeds the angle at which the same force steadily applied would keep it at rest. This is evident immediately from the consideration that, from the upright position to that in which the vessel would be held permanently inclined, the inclining force exceeds the force resisting inclination; hence *vis viva* is accumulated in the vessel up to that position which, by reason of its velocity, it must pass beyond. Once beyond that point, the inclining force is less than the resisting force, and the *vis viva* is gradually diminished until it is destroyed. It is evident that there would arise hence an oscillating motion. It is undoubtedly important to ascertain that, in passing to the extreme angle of inclination, the vessel pass through no new position of equilibrium which would be one of *instability*, or that the angle be not otherwise dangerous or inconvenient.

Viewed in this light, the question of dynamical stability might advantageously be applied to ships. A vessel of given class of known stability might be fixed upon, and the greatest angle to which it has been known to be inclined in a violent gale taken as a standard. Then from the draughts of

a proposed ship of the same class it should be determined whether it would be inclined by the same force through a greater or less angle; and the draughts might be altered if that angle were too great, so as to bring it within the proper limits. The mode of ascertaining this is readily given by the consideration, that the *work* done by the inclining force must be equal to the *work* done in raising the vessel through the *difference* of the vertical heights, through which the centre of gravity and buoyancy of the ship have been raised during the inclination. To apply this to the figure before us, HZ−EG evidently represents this difference. Draw EF perpendicular on HR. Then $HZ = HF + FZ = HF + EG \cos. ELZ = HF + EG \cos. \theta$ (if θ is the angle through which the ship is inclined), and $HZ - EG = HF - EG (1 - \cos. \theta) = HF - EG \text{ vers } \theta$.

Hence the work done on the vessel, which measures the dynamical stability $= W.HF - WEG \text{ vers } \theta$. Now, if g and h are the projections on the plane ADB of the centres of gravity of the wedges of which ASP, BSQ are the bases, and mg, nh perpendiculars from them on PQ, and if w be the weight of either of these wedges (for they must be equal), then it is easily proved by a property of the centre of gravity that $W.HF = w\ (mg + nh) = wz$ suppose. Therefore, the dynamical stability $= w(mg + nh) - Wd \text{ vers } \theta. = wz - Wd \text{ vers } \theta$. It must, however, be carefully borne in mind that the two measures of stability which have been proposed, viz., the *statical* and the *dynamical*, must not be confounded. The object of the latter is to insure the vessel against danger arising from any sudden blow or any violent accession to a storm; the object of the former is to secure that, under the steady action of a gale of wind, the vessel shall not be permanently inclined beyond a certain angle, on which some of its most important qualities greatly depend. First, it is evident that the less *a ship inclines* under a steady wind on the beam, the more weatherly she will be (other circumstances being equal), for the lateral resistance of the water will be then greatest, and therefore offer most opposition to the ship's progress in a lateral direction; in other words, she will make less leeway. Again; being able to carry more sail, she will be faster than if she were more inclined. And, what is a most important quality for a ship of war, she will carry her lower deck well out of water, so as to be able to work well her guns on that deck. It is true that there are limits to the useful amount of stability; no wind can be considered in all respects steady—but there will be sometimes diminutions, and sometimes accessions to its mean strength. The effect of these will be occasional oscillations about the mean position at which it is kept permanently inclined. The moment of stability may be so great as to cause the vessel, after reaching the extremity of one of such excursions, to return with extreme violence; an thus produce serious and mischievous effects, tending to weaken the vessel itself, and to render the use of her batteries difficult and dangerous to those on board. It is, moreover, important that when she is rolling in consequence of the agitation of the sea by waves, the rolling should be *easy*—not too quick, especially when first beginning her backward motion, after she has passed through the extreme amplitude of her rolling. If the vessel were in action in such circumstances, the moment at which she has completed her *roll* would be the time for firing; and this would evidently be made very uncertain and difficult if, instead of resting as it were for a moment (which is the case in good ships), she were to return very suddenly. This effect is generally produced if the stability be too great. Here, then, as before, recourse must be had to a standard vessel.

(To be continued.)

MATHEMATICAL PERIODICALS.

(Continued from vol. liii., p. 505.)

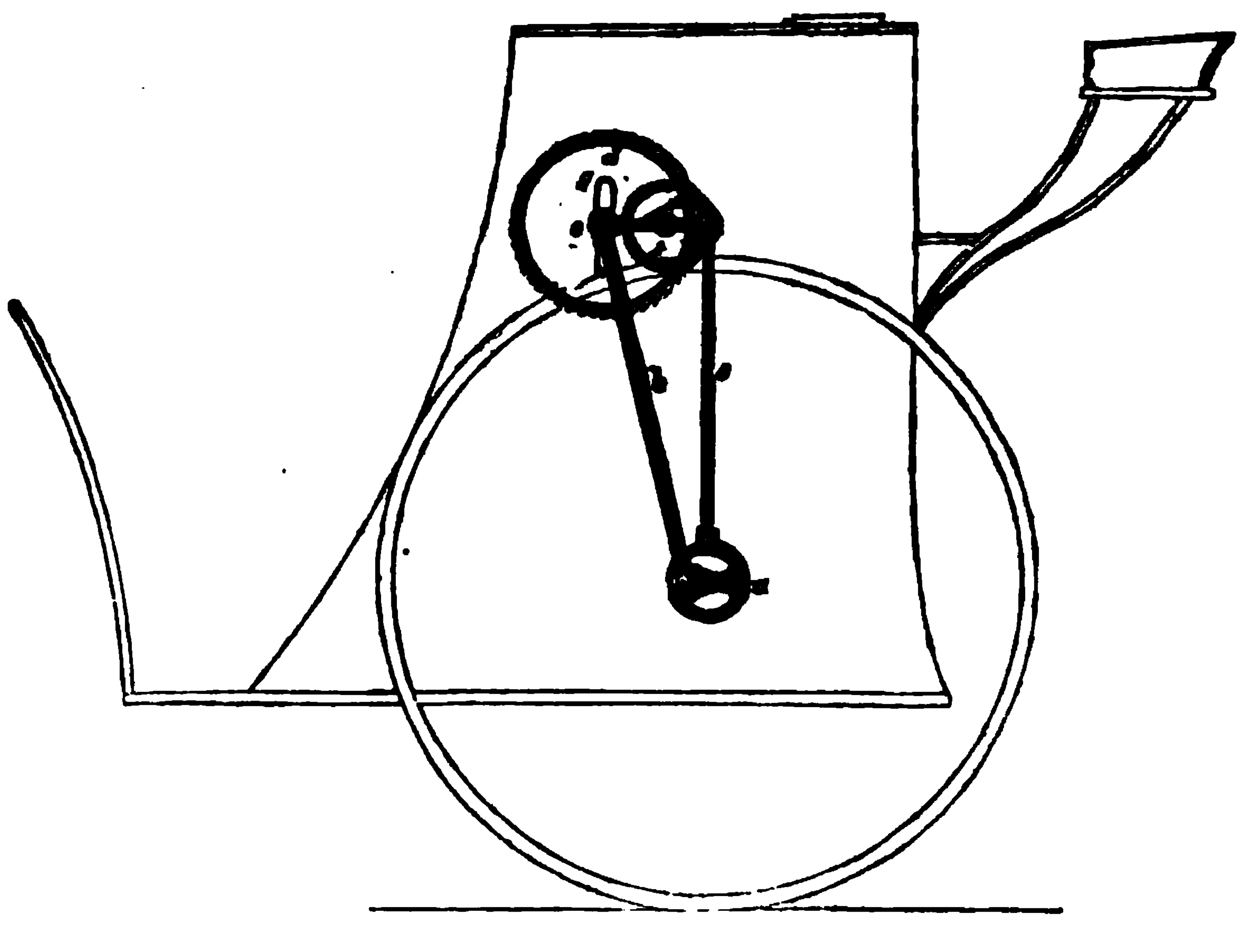
No. XXVII. *The Enigmatical Entertainer and Mathematical Associate.*

Origin.—The first number of this periodical was issued in November, 1827, under the title of "The Enigmatical Entertainer and Mathematical Associate" for the year 1828: it was intended to supply the place of the "Gentleman's Mathematical Companion," but was con-

ducted "in a manner somewhat different from that of its predecessor." The Editors declare themselves as "by no means actuated by any spirit of opposition, but our wish is, merely to contribute to Enigmatical and Mathematical amusement, after the manner of those two excellent little works, the 'Lady's' and the 'Gentleman's Diaries,' which have been so long and so deservedly supported." A contributor "would fain persuade himself that talents equal to those which shone with such brilliancy in the 'Lady's Diary' in the days of the *Connumdrums*, the *Bentleys*, the *Tassos*, the *Woolstons*, and a host of others, are yet to be found, and would step forward to the support of a work providing so liberally for their amusement;" and the Editors evince no less anxiety "to promote the mathematical department, by a careful attention to what may be furnished to us; and duly considering that our object is also the advancement of mathematical knowledge, we shall impartially select for publication whatever may be deemed most likely to facilitate the progress of those sciences; and in so doing, we shall not disregard the hints of some of our mathematical contributors 'not to indulge a too rigid and unbending attachment to the geometry of the Greeks, to the *exclusion* of those branches of the mathematics which are now very generally pursued:' but while we endeavour to keep alive a taste for the remains of Pythagoras and Plato, we hope also to direct our readers into the wider fields of inquiry which the modern analysis has disclosed." These intentions, however, were not destined to be carried out for any lengthened period. In No. IV. "for the year 1831," the proprietors "return their best acknowledgments to the various contributors for the assistance they have from time to time received from them; and also inform them, that, as it is inconvenient for them to carry on the work, this number will be the last." The whole work contains vi + 166 + 88 small octavo pages.

(*To be continued.*)

SELF ACTING DISTANCE REGISTER FOR CABS.



Sir,—I beg leave to forward you a sketch of a self-acting distance register, which could easily be applied to cabs, or other conveyances,

Attention having been of late called to this subject, I am sure that any suggestion calculated to protect the public from imposition, will be favourably received.

Description of the Register.

a, eccentric fixed on the nave or bars of the wheels; *b*, distance bar; *c*, eccentric rod; *d*, ratchet-wheel; *e*, small pinion on axis of ratchet-wheel; *f*, spur-wheel, attached to dial-plate; *g*, groove fixed to cab, to allow for the movement in its springs.

It will clearly be perceived, on reference to the sketch, that for every revolution of the cab wheels, the ratchet-wheel, acted upon by the eccentric, will advance 1 tooth; or, in other words, we will suppose the cab-wheel 5·5 yards in circumference—the ratchet-wheel having 100 teeth, the cab will run over 550 yards, for one revolution of the ratchet-wheel: again, the small pinion *e*, having 100 teeth, and being fixed on the same axis as the ratchet-wheel, and working into the spur-wheel, *f*, which has a proportion of 3·2 on the pinion; will give,

yards.
550 × 3·2 = 1760 yards, or one mile.

The distance run over could be shown on a dial-plate, indicating the mileage and fares, placed inside the cab, which the passenger could fix at zero on entering.

I am, Sir, yours obediently,

GEORGE MAUGHAN, C.E.

Mons, Belgium, May 21, 1851.

FINCHAM'S "HISTORY OF NAVAL ARCHITECTURE."—REPLY OF DR. WOOLLEY TO MR. FINCHAM

Sir, — There are remarks in Mr. Fincham's letter which you have inserted in this week's *Mechanics' Magazine* which demand a reply from me. I certainly shall not imitate him in the insinuation of unworthy motives; and I shall notice his remarks no further than will be necessary for my own vindication. Mr. Fincham *asserts*, that my former letter owes its origin "not to the desire of guarding the boundaries of science, or supporting the confidence of practical men," but to some motive or motives which he leaves wrapped in mystery. Had my object been, as he doubtless wishes to convey, to discredit the scientific portion of his work, I can assure him that the opportunity of so doing was by no means wanting; but I *purposely* and *cautiously* abstained from all remarks, but such as were immediately called for by the question to which I desired to draw attention; and I must say that my imputation of a grave responsibility to Mr. Fincham or his mathematical advisers was hardly sufficient to warrant the tone of his rejoinder.

In Mr. Fincham's opinion courtesy demanded of me a private communication to him, of such statements in his book as appeared of doubtful accuracy. The experience of the last few months has shown me that *private communications* by no means preclude the probability of misrepresentation. I therefore preferred the more open course of calling attention to his note, which appeared objectionable, through your Magazine.

The work itself, besides, contains statements which proclaim in too marked a manner the kind of value which he sets by such representations, encourage me to try the experiment. Mr. Fincham, at all events, has little reason to complain of my coming forward publicly, as it has left him at liberty to reply in a way which best suited him. As, however, he has thought fit to make insinuations of such a nature, I feel now no hesitation in stating what otherwise out of regard to him I did not even hint at in my former letter; viz., that whatever value his book may possess as a record of *practical* improvements in ship-building, and of the trials which have from time to time been made between vessels of different forms—the hasty introduction of investigations which rest on no solid foundation, and have not received the sanction of the scientific world renders it an indifferent guide to the progress of science applied to naval architecture. Nothing more is, I believe, necessary on my part to vindicate me from the inuendos which Mr. Fincham has thought fit to throw out.

Mr. Fincham also stigmatises my allusion to his mathematical advisers as "ungenerous." A great part of his introduction, at least, is evidently the work of one who has some mathematical attainment; and as Mr. Fincham has never

put forth pretensions to an acquaintance with the exact sciences, or, at least, has successfully concealed it from those in association with whom much of his official life has been past, I was astonished at his indignation, for I should conceive it no disparagement to his extensive acquirements to attribute the *mathematical portions* of his work to some other hand. Nor was my astonishment lessened when I found that he claimed Dr Inman as his "mathematical adviser."

His professional connection with that eminent mathematician has, however, long since ceased; and I referred to that person, or those persons to whom he is indebted for no inconsiderable portion of his work.

Are we, then, to hold Dr. Inman responsible for the Note which has occasioned the present correspondence,—for the various investigations which appear in the Introduction,—for the "important scientific results" on the screw propeller which appear later? Nay, I will ask, what single scientific man of any note has given his sanction to these latter results? Who has admitted the claim of these novel researches to rank side by side with the labours of such men as Euler, the Bernoullis, Chapman, and other undoubted authorities?

I must now advert to an unfair use of the concluding words of my letter which Mr. Fincham has made. He evidently desires to set me in open hostility with all draughtsmen and calculators, whether in the public or private service. My words fairly bear no such construction; and I unhesitatingly repudiate all intention of casting a slur on them. Is Mr. Fincham the tutor of all the draughtsmen who are skilled in making calculations, that he presumes to say I impute a want of accuracy to *his* pupils? If, as he declares, they follow carefully the rules which he himself received from Dr. Inman, I have no doubt that their work is essentially correct and accurate.

It is time, however, to come to the Note itself. *Every one knows* that the methods commonly in use for ascertaining the solid contents of a ship's body are *only approximations.* I should scarcely have conceived that Mr. Fincham would have committed such a puerility as to introduce a foot-note for the *express purpose of pointing out a truism.* Besides, in that Note, *a doubt* is expressed. That the methods do not give the *exact* contents, admits of *no doubt.* That doubt, therefore, has every appearance of bearing a reference to the *sufficient accuracy* of the methods. Such was certainly my impression; and such, I doubt not, would be the impression of every unbiassed person on reading it. I rejoice to find that Mr. Fincham had no such meaning. Why then introduce the Note at all—or, at all events, in such words as were calculated to produce misapprehension?

I have myself heard doubts expressed as to the value of these rules as founded on the principles of exact science, which were not unlikely to have come to Mr. Fincham's knowledge. As the Note in question bears every mark of at least a seeming participation by him in such doubts, I thought it a "*dignus vindice nodus,*" and so came to the rescue.

I regret that Mr. Fincham should have thought it necessary for his own vindication to cast a slur on my humble attempt to "support the confidence of practical men" by the publication of "a new mode of finding the displacement." It is evident, however, that he has made himself acquainted with the *name* only. The novelty does not consist, as he states in finding the displacement by the ordinates *only;* but by a *single operation* without, *i. e.*, first calculating the areas of the sections, and using them as new ordinates. The rule is simple, and entirely distinct from the common rules, as is sufficiently evident from the fact that *all* the ordinates are not required for its application.

But although the method *is* new, my express object in calling attention to it was to show that the results which it gives are, in fact, identical with those given by the ordinary rules. I am not surprised at Mr. Fincham's depreciation of it; for as it is obtained by the application of the integral calculus to solid geometry, he is not in a situation to judge of its accuracy. But to *any mathematician* I submit it with confidence; and its value I consider to be this—that it places the *closeness* of the approximation by the ordinary methods *beyond a doubt.*

To place this in a clearer light before

your readers, it may be worth while to state what the method, in fact, amounts to. A prism is taken from the body, one end of which is a plane triangle, and the other a portion of the *irregular surface*. Ordinates are drawn from six points in the base at regular intervals to the surface; and a paraboloidal surface is drawn through the extremities of these six ordinates, and substituted for the original surface.

The volume of the prismatic solid thus formed, is calculated and taken as an *approximation* to that of the original solid. This process is repeated for similar prisms throughout the body; and the sum of the results so obtained is evidently a close approximation to the volume of the whole body, if the ordinates are taken sufficiently near; for in that case only the *very small portions of space between the two surfaces* are neglected. The rule thus obtained (of very easy application) gives results, *even in the largest ships*, agreeing with those given by Simpson's rule *within a small decimal of a ton*. This points out clearly enough what dependence is to be placed on the ordinary rules, and is a sufficient answer to those *imaginary* sources of inaccuracy which Mr. Fincham has suggested in his letter to you. Surely he can hardly be serious in indulging the expectation that any *exact* mode of calculating the volume of an *irregular* solid is likely to be discovered, or that scientific men would think it worth their while to waste their energies in such a wildgoose chase. For my part, I indulge in no such day-dreams, and am abundantly satisfied with the degree of accuracy which is now within our reach, and shall be glad indeed if my humble efforts serve to confirm in practical men a conviction of the value of the instrument put into their hands.

I regret very much that the discharge of what I considered a duty to the public should have placed me in collision with a gentleman whose private character and practical attainments in his profession I esteem so highly as I do Mr. Fincham's.

I acknowledge gratefully the assistance which I received from his kindness in *acquiring a practical knowledge* of ship-building by the help of two of his works, which he presented to me on my first arrival at Portsmouth. But Mr. Fincham has never communicated with me at all on matters connected with the *science* of his profession; neither have I sought or obtained any aid of such a nature from him.

My very knowledge of his being engaged on a work like that which he has just given to the world was derived from rumour and quotations of it in scientific works before it was published; which surely is a sufficient indication of the slightness of the ties which have *professionally* connected us.

To Dr. Inman I, together with himself, am under the greatest obligations, and if my letter produces no other good result, I am delighted that it has called forth so distinct and candid, though not too flattering, a recognition of the claims of that distinguished mathematician, to the gratitude of the country for his eminently successful labours in the cause of naval architecture. I have had the happiness and honour of much intercourse with him during the last three years, and have received many proofs of his kindness; and to him am indebted for my initiation into the rules for the calculations in naval architecture; for from him I received the distinguished honour and mark of confidence of his having placed in my hands, in manuscript, (with permission to copy it) the "pamphlet" to which Mr. Fincham and myself have had occasion to refer. It has been no little aid to me in the discharge of duties of a novel nature to have been able to sit at the feet of the highest living authority in this science, and to have received his kind permission to have recourse to him on all occasions—a permission of which I have not failed to make extensive use, and which I am delighted to have the opportunity of gratefully acknowledging.

I am, Sir, yours, &c.,

JOSEPH WOOLLEY.

ON THE CONSTRUCTION OF STEAM BOILERS AND THE CAUSES OF THEIR EXPLOSIONS. BY WM. FAIRBAIRN, ESQ., C.E., F.R.S.

(Continued from p. 437.)

In the construction of boilers exposed to severe internal pressure, it is desirable to establish such forms, and so to dispose the material as to apply the greatest strength in the direction of the greatest strain; and in order to accomplish this, it will be necessary to consider whether the same arrangement

be required for all diameters, or whether the form as well as the disposition of the plates should not be changed. To determine these questions in cylindrical boilers, recourse must be had to experiment, or such deduction as may apply to any given case, and such as is founded upon unerring data derived from experimental research. On this head I am fortunate in having before me the calculations of Professor W. R. Johnson, of the Franklin Institute of America, whose inquiries into the strength of cylindrical boilers are of great value, and from which the following short abstract may be useful.

"1st. To know the force which tends to burst a cylindrical vessel in the longitudinal direction, or, in other words, to separate the *head* from the curved *sides*: we have only to consider the actual area of the head, and to multiply the units of *surface* by the number of units of *force* applied to each superficial unit. This will give the total *divellent* force in that direction.

"To counteract this, we have, or may be conceived to have, the tenacity of as many longitudinal bars as there are lineal units in the circumference of the cylinder. The united strength of these bars constitutes the total retaining or *quiescent* force, and at the moment when rupture is about to take place, the *divellent* and the quiescent forces must obviously be equal.

"2nd. To ascertain the amount of force which tends to rupture the cylinder along the curved side, or rather along the opposite sides, we may regard the pressure as applied through the whole breadth of the cylinder upon each lineal unit of the diameter. Hence the total amount of force which would tend to divide the cylinder in halves, by separating it along two lines, on opposite sides, would be represented by multiplying the diameter by the force exerted on each unit of surface, and this product by the length of the cylinder. But even without regarding the length, we may consider the force requisite to rupture a *single band* in the direction now supposed, and of one lineal unit in breadth; since it obviously makes no difference whether the cylinder be long or short, in respect to the ease or difficulty in separating the sides. The *divellent* force in this direction is therefore truly represented by the diameter multiplied by the pressure per *unit of surface*.. The retaining or *quiescent* force, in the same direction, is only the strength, or tenacity of the two opposite sides of the supposed bond. Here also, at the moment when a rupture is about to occur, the divellent force must exactly equal the quiescent force."

Mr. Johnson then goes on to show that as the diameter is increased, the product of the diameter and the force or pressure per unit of surface is increased in the same ratio. This truism I shall endeavour to prove; as also, that as the diameter of any cylindrical vessel is increased, the thickness of the metal must also be increased in the exact ratio of the increase of the diameter,—the pressure, or, as Mr. Johnson calls it, the divellent force being the same; when the diameter of a boiler is increased, it must be borne in mind that the area of the ends is also increased, not in the ratio of the diameter, but in the ratio of the square of the diameter; and it will be seen that instead of the force being doubled, as in the case of the direction of the diameter and circumference, it is quadrupled upon the ends,—or, what is the same thing, a cylinder double the diameter of another cylinder, has to sustain four times the pressure in the longitudinal direction.

The retaining force or the thickness of the metal of a cylindrical boiler does not however increase in the same ratio as the area of the circle, but simply in the ratio of the diameter; consequently, the thickness of the metal will require to be increased in the same ratio as the diameter is increased. From this it appears that the tendency to rupture by blowing out the ends of a cylindrical boiler will not be greater in this direction than it is in any other direction; we may, therefore, safely conclude, since we have seen that the tendency to rupture increases in both directions in the ratio of the diameter, that any deviation from that law, as regards the thickness of the plates, would not increase the strength of the boiler.

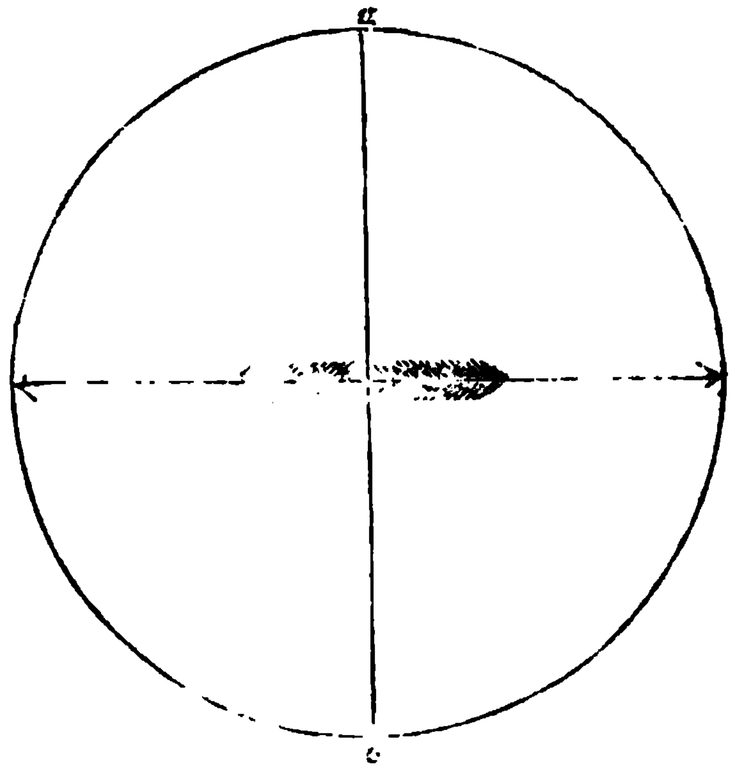
I have been led to these inquiries from the circumstance that Mr. Johnson appears to reason on the supposition that there are no joints in the plates, and that the tenacity of the iron is equal to 60,000 lbs., rather more than 26 tons to the square inch. Now we have shown by the results of the experiments already adduced, that ordinary boiler plates will not bear more than 23 tons to the square inch; and as nearly one-third of the material is punched out for the reception of the rivets, we must still further reduce the strength, and take 15 tons, or about 34,000 lbs.* on the square inch, as the tenacity of the material, or the pressure at which a boiler would burst.

* By experiment, it is found that the strength of the riveted joints of boilers is only about one-half the strength of the plate itself; but taking into consideration the crossing of the the joints 34,000 lbs. may reasonably be taken as the tenacity of the riveted plates, or the bursting pressure of a cylindrical boiler.

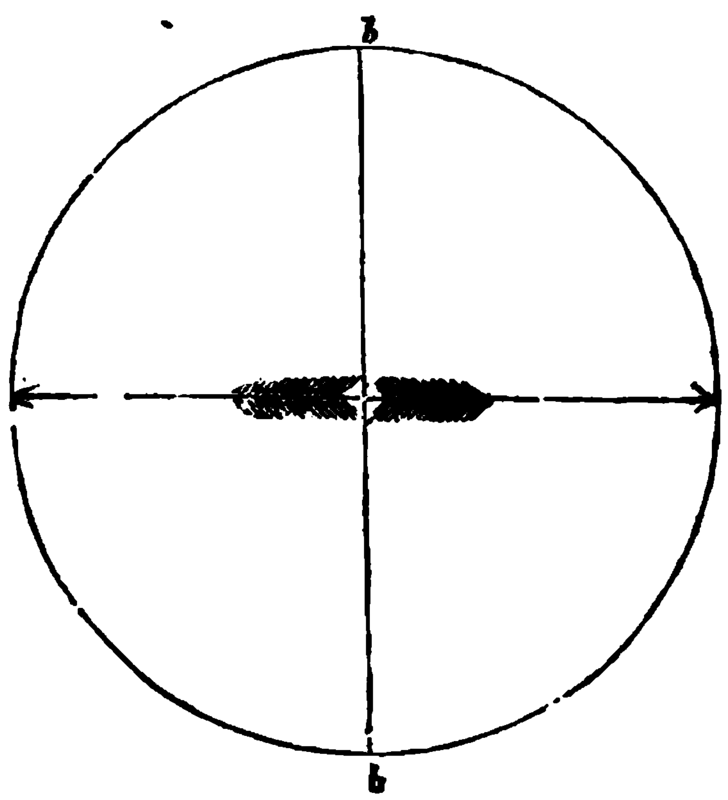
This I should consider in practice as the maximum power of resistance of boiler plates in their riveted state; and I will now trouble you to follow me in a very concise, and I trust not uninteresting investigation as to the bearing powers of boilers, and the pressure at which they can be worked with safety.

It has been stated that the strengths of cylindrical boilers, when taken in the direction of their circumference, are in the ratio of their diameters, and when taken in the direction of the ends, as the squares of the diameters,—a proportion which it will not be difficult to demonstrate as applicable to every description of boiler of the cylindrical form. It will be seen, however, that the strain is not exactly the same in every direction, and that there is actually less upon the material in the longitudinal direction, than there is upon the circumference. For example; let us take two boilers, one 3-feet diameter and the other 6-feet, and suppose each to be subject to a pressure of 40 lbs. to the square inch. In this condition, it is evident that the area or number of square inches in the end of a 3-feet boiler is to that of the area of the 6-feet boiler as 1 to 4, and by a common process of arithmetic it will be found that the edges of the plates forming the cylindrical part of the 3-feet boiler is subject (at 40 lbs. on the square inch) to a pressure of 40,712 lbs.—upwards of 18 tons—whereas the plates of the 6-feet boiler have to sustain a pressure of 162,848 lbs., or 72 tons, which is quadruple the force to which the boiler, only one-half the diameter, is exposed; and the circumferences being only as two to one, there is necessarily double the strain upon the cylindrical plates of the larger boiler. Now, this is not the case with the other parts of the boiler, as the circumference of a cylinder increases only in the ratio of the diameter; consequently the pressure, instead of being increased in the ratio of the squares of the diameter, as shown in the ends, is only doubled,—the circumference of the 6-feet boiler being twice that of the 3 feet boiler.

Let us, for the sake of illustration, suppose the two cylindrical boilers, such as we have described, to be divided into a series of hoops of 1 inch in width; and, taking one of these hoops in the 3-foot boiler, we shall find it exposed at a pressure of 40 lbs. on the square inch, to a force of 1,440 lbs., acting on each side of a line drawn through the axis of a cylinder 36 inches diameter, and 1 inch in depth, and which line forms the diameter of the circle. Now, this force causes a strain upon the points *a a* in the direction of the arrows in the annexed diagram of the 3 feet circle of 720 lbs., and assuming the pressure to be increased till the force becomes equal to the tenacity or



retaining powers of the iron at *a*, *a*, it is evident, in this state of the equilibrium of the two forces, that the least preponderance on the side of the internal pressure would insure fracture. And, suppose we take the plates of which the boiler is composed at one quarter of an inch thick, and the ultimate strength at 34,000 lbs. on the square inch, we shall have $\frac{3,40}{36 \times 2} = 472$ lbs. per square inch as the bursting pressures of the boiler. Again: as the forces in this direction are not as the squares, but simply as the diameter, it is clear that at 40 lbs. on the square inch, we have in a hoop an inch in depth, or that portion of a cylinder whose diameter is 6 feet, exactly double the force



applied to the points *b*, *b*, as was acting on the point *a*, *a*, in the diameter of 3 feet,

Now, assuming the plates to be a quarter of an inch thick, as in the 3-feet boiler, it follows, if the forces at the same pressure be doubled in the large cylinder, that the thickness of the plates must also be doubled, in order to sustain the same pressure with equal security; or what is the same thing, the 6-feet boiler must be worked at half the pressure, in order to ensure the same degree of safety as attained in the 3-feet boiler at double the pressure. From these facts it may be useful to know, that boilers having increased dimensions should also have increased strength in the ratio of their diameter; or, in other words, the plates of a 6-feet boiler should be double the thickness of the plates of a 3-feet boiler, and so on in proportion as the diameter is increased.

The relative power of force applied to cylinders of different diameters become more strikingly apparent when we reduce them to their equivalents of strain per square inch, as applied to the ends and circumference of the boiler respectively. In the 3-feet boiler, working at 40 lbs. pressure, we have a force to 720 lbs. upon an inch width of plate, and one quarter of an inch thick, or 720 by 4, equal 2,880 lbs.; the force per square inch upon every point of the circumference of the boiler.

Let us now compare this with the actual strength of the riveted plates themselves, which taken as before at 34,000 lbs. on the square inch, we arrive at the ratio of pressure as applied to the strength of the circumference as 2,800 to 34,000, nearly as 1 to 12, or 472 per square inch, as the ultimate strength of the riveted plates.

These deductions appear to be true in every case as regards the resisting powers of cylindrical boilers, to a force radiating in every direction from its axis towards the circumference; but the same reasoning is, however, not maintained when applied to the ends, or, to speak technically, to the angle iron, and riveting where the ends are attached to the circumference. Now, to prove this, let us take the 3-feet boiler where we have 113 inches in the circumference, and upon this circular line of connection we have at 40 lbs. to the square inch to sustain a pressure of 18 tons, which is equal to a strain of 360 lbs. acting longitudinally upon every inch of the circumference. Apply the same force to a 6-feet boiler, with a circumference or line of connection equal to 226 inches, and we shall find it exposed to exactly four times the force, or 72 tons; but in this case it must be borne in mind that the circumference is doubled, and consequently the strain, instead of being in the quadruple ratio, is only doubled, or a force equal to 720 lbs. acting longitudinally as before upon every inch of the circumference of the boiler. From these facts we come to the conclusion that the strength of cylindrical boilers is in the ratio of their diameters if taken in the line of curvature, and as the squares of the diameters as applied to the ends or their sectional area; and that all descriptions of cylindrical tubes, to bear the same pressure, must be increased in strength in the direction of their circumference simply as their diameters, and in the direction of the ends as the squares of the diameters.

(To be continued.)

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JUNE 4, 1851.

Francis Frederick Woods, of Pelham-terrace, Brompton, builder. *For improvements in paving.* Patent dated November 30, 1850.

Mr. Woods' improved paving is constructed of wood and stone, so combined as to be free from the disadvantages incidental to pavings composed of wood alone.

The surfaces of the blocks of wood employed (which are disposed with the grain inclining upwards) are grooved in parallel or zigzag lines, or have recesses formed in them, which are filled with coarse sand or broken granite such as is used for Macadamizing, or with cubes or blocks of stone, and ground lime or cement in either case. The blocks of wood are supported on a flooring of planks, laid on a bed of concrete in all cases where the road will be subject to much traffic; but this plank bed may be in other cases dispensed with. Another arrangement which Mr. Woods adopts, in place of large blocks of wood, is to employ three-inch planks cut into short lengths, and with angular portions removed, so as to form, when laid down close together, zigzag grooves, which are filled, as above directed, with broken stone and ground lime.

Claim.—The combination of wood and stone for constructing pavings for roads and ways.

Robert Olddiss Bancks, of the firm of Bancks Brothers, of Wierhouse Mill, Chesham, and Piccadilly, paper-makers and card-makers. *For improvements in the manufacture of paper.* Patent dated November 30, 1850.

These improvements have relation to the production of the "water-mark," which has been usually effected by sewing on to the surface of the mould or dandy-roller flattened wire, so as to produce a mark or design of a simple or ornamental character. This method is open to objections, espe-

cially in the production of ornamental designs; and to obviate these, Mr. Bancks proposes to cut out the figures, letters, or designs from thin sheets of metal, by a saw or other suitable instrument, as in the process of buhl-cutting, and to affix such design to the mould or roller by means of wire, sewing, or solder.

Claim.—The adaptation of marks or devices, cut or pierced from plates of metal or other suitable substance, by saws or other instruments, to the moulds or dandy-rollers used in the manufacture of paper, for the purpose of producing water-marks therein.

JAMES AUGUSTUS ELMSLIE and GEORGE SIMPSON, of Union-buildings, Leather-lane. *For improvements in sheathing ships, and in protecting and confining gunpowder and certain compounds thereof, and in materials used for such purposes.* Patent dated November 30, 1850.

The improvements here specified and claimed are—

1. The application of tinfoil, or sheets of tin, or of alloys of a similar nature, as a sheathing for ships to be applied beneath the copper or Muntz, metal sheathing, in lieu of the felt or paper ordinarily employed. The tin foil is fastened on with copper tacks, with or without adhesive cement.

2. The employment of tinfoil, or other metal or alloy of a similar nature, in the manufacture of cartridges for muskets and other fire-arms and cannon.

3. The employment of tinfoil, or other metal or alloy of a similar nature, in the manufacture of wadding; and also the use, for the same purpose, of spent hops and other similar vegetable materials, rendered incombustible by soaking in lime and water, or any suitable solution, either alone or in combination with tinfoil, &c.

4. The employment of tinfoil, or other metal or alloy of a similar nature, for the manufacture of cases for rockets and fireworks generally, and for covering the cases of such fireworks when made of paper.

FREDERICK BUONAPART ANDERSON, of Gravesend, optician. *For certain improvements in spectacles.* Patent dated November 30, 1850.

These improvements have for their object the construction of spectacles in such a manner that when taken from the face the side-pieces or "temples" shall fold over the frame, and become closed without the inconvenience of applying the hands to fold them up, and whereby also the liability to fall from the face is to a great extent prevented.

Both these objects are attained by inserting into the joint end of each of the temples (which are slotted out for the purpose) a convolute spring, the inner end of which fits into a slit made in the pin of the joint, while the opposite extremity is slightly bent outwards so as to catch upon the edge of a slot formed in the "temple." When the rivet or pin of the joint is fixed in its place, the spring is so set as to cause the "temples" to lie flat upon the frame, and when the spectacles are on the face, to exert a slight pressure against the head of the wearer, and keep them from falling off. A small loop or eye is affixed to the frame-joint for receiving a ribbon or guard to render the spectacles more easily portable.

Claims.—1. The constructing of spectacles with springs inserted into the joints for the purposes of making the "temples" fold down upon the frame when not in use, and for retaining the spectacles when on, from falling off the head of the wearer.

2. The affixing of an eye or loop to the joints of spectacles, for the purpose of rendering them more easily portable.

HENRY JULES BORIE, of Boulevard Poissonnière, engineer. *For improvements in the manufacture of bricks.* Patent dated November 30, 1850.

The improvements here claimed consist in arranging and constructing moulds for forming hollow bricks by pressing clay through them in such manner that the bar or bars which carry the stems for making the holes or perforations in such bricks may be placed opposite to the solid portions or partitions thereof, instead of in their usual positions, thus lessening the liability to crack, to which such bricks are subject, and admitting of a greater number of perforations being made.

RICHARD BLAKEMORE, of the Leys, GANEROW, HEREFORD, Esq., M.P. *For improvements in the construction of ploughs.* Patent dated November 30, 1850.

These improvements consist in attaching the coulter to the mould board or lower part of the plough, instead of to the frame or beam, and extending vertically downwards in the usual manner. The liability to clog with weeds, rubbish, &c., is stated to be thus considerably lessened, and from the cut being made in an upward direction, facility of working is increased.

No claim is made to the construction of ploughs, otherwise than as regards the disposition of the coulter, above described.

HENRY POTTER BURT, of Blackfriars-road, civil engineer. *For improvements in the manufacture of window-blinds.* Patent dated November 30, 1850.

The blinds here referred to are those known as "Venetian blinds;" and the improvements consist,

1. In making the laths of iron or metal embossed, perforated, corrugated, or simply curved, and painted, japanned, or otherwise ornamented according to taste.

2. In an arrangement for raising and lowering such blinds, and preserving the parallelism of their laths without the multiplicity of cords generally employed.

JOHN AINSLIE, of Alperton, draining engineer. *For certain arrangements and apparatus for the manufacture of bricks, tiles, and other articles made from clay and other plastic materials; parts of the said arrangements and apparatus being applicable to the treatment of earths, minerals, animal and vegetable matters.* Patent dated November 30, 1850.

1. Mr. Ainslie specifies an arrangement of apparatus for crushing, pulverizing, and mixing clay and other substances, consisting of two spindles parallel to each other, on which are mounted circular discs of metal, bevelled off towards the edges, and grooved or corrugated at the sides, and so disposed that the intermediate spaces of one set of discs shall be occupied by the dics on the other spindle. The substances to be operated on are fed into the machine from above, and reduced to any extent by grinding between the sides of the discs which are caused to revolve in opposite directions from any suitable driving power. This arrangement is also claimed as applied to forcing clay or other plastic materials into moulds.

2. The improvements have relation to kilns for baking bricks, which may be also employed for drying purposes. A flue is made to wind spirally around the baking chamber (which is in some cases built at an angle, the bricks being supplied at the top and falling down gradually to the bottom) before passing into the chimney, and a more uniform degree of heat is thus obtained. In the case of circular ovens, the floor is heated by a flue of a spiral form constructed underneath it, and a spiral flue also winds round the body of the oven to any required height.

WILLIAM HENRY RITCHIE, of Kennington, gentleman. *For improvements in stoves.* Patent dated November 30, 1850.

The principal object of these improvements, which relate to what are called "close stoves," is the constructing of them in such manner as to admit of their being moved from place to place without injury to the floor or carpet on which they may be deposited. The fire-pan is covered in at top by a sand-bath, to prevent the products of combustion entering the room; and the heated air passes through the fire-pan into a casing, and is again supplied to the fire mingled with a sufficiency of pure air (admitted from a series of apertures in the lower part of the casing), to supply the place of the oxygen abstracted by the fire. The stove is provided with handles, to facilitate its removal. Another improvement consists in stamping the ornamental parts of such stoves from wrought iron, instead of casting the whole at one operation.

Claim.—The mode of constructing stoves described.

RICHARD BARBER, of Hotel-street, Leicester. *For improvements in the manufacture of reels for reeling, and stands for reels, which improvements are applicable to the manufacture of desk or wafer seals.* Patent dated November 30, 1850.

Mr. Barber claims—

1. The manufacture of reels in one piece from metal of any suitable description, or from horn or hoof.

2. A method of holding together the parts of the mould employed for casting reels and reel-stands, and for forming such reels and stands from horn, hoof, or shell, by pressure. Also an arrangement of the central parts of the mould in such manner as to admit of the employment of a compound wedge for holding the parts in a position after removal from the mould until the horn or hoof has set permanently.

3. A method of casting reel-stands at one operation from metal, and of making such stands by pressure from horn, hoof, or shell.

4. A method of casting the handles of desk or wafer seals with a hollow or recess formed in the end thereof to receive a piece of glass or hoof, to produce an impression from wax or wafers.

HENRY DUNCAN PRESTON CUNNINGHAM, of Bury, Hants, paymaster and purser, R. N. *For improvements in reefing sails.* Patent dated November 30, 1850.

Claim.—The reefing of the top-sails, top-gallant sails, and courses of square rigged vessels by certain combinations of means described, that is to say, by rolling the sails upon the yards by causing the yards to revolve for that purpose, either by employing the weight of the sails, yards, and appendages, to assist in producing the rotation of the yards, or by communicating the necessary rotation by pulleys from the deck together with the employment, to effect the said object, of various contrivances particularized and described.

CHARLES ROWLEY, of Birmingham, manufacturer. *For improvements in the manufacture of dress-pins, and other dress fastenings and ornaments.* Patent dated November 30, 1850.

These improvements are rather multifarious, and of such a nature as to render a brief description of them hardly intelligible without the aid of drawings. The claims include several methods of protecting the points of shawl and other pins and brooches, of attaching the pins to the latter, of attaching waistcoat buttons and shirt studs, of fastening ladies' dresses, and a mode of

manufacturing "Maltese" buttons by stamping the shell with a fly-press and securing the two parts together without the aid of solder.

JOSEPH EUGENE CHABERT, of Paris. *For improvements in machinery for washing and drying linen and other fabrics.* Patent dated November 30, 1850.

The articles to be washed are stretched on frames or placed in wire gauze baskets suitably supported by standards in closed vessels of water and washing materials, and caused to oscillate backwards and forwards, or to receive a rotating oscillatory movement from a steam engine in connection therewith. It is preferred to maintain the water in the vessel at a uniform temperature by steam pipes. The rinsing is effected in the same vessel by changing the water. In order the more expeditiously to fit the articles for the drying processes, they are submitted to pressure, and then passed between steam-heated cylinders; two arrangements of which are represented in the drawings.

Claim.—The mode described of arranging machinery for washing and drying linen and other fabrics.

RICHARD SHIERS, of Oldham, manufacturer, and JAMES HEGINBOTTOM, of the same place, manager. *For improvements in the manufacture of textile fabrics.* Patent dated December 2, 1850.

Claims.—1. In the manufacture of the fabrics known as "cotton tabby velvets," "cotton Genoa velvets," and "cotton velveteens," the regulation of the motions of the threads in such manner that the round of floating or pile picks, or a portion thereof, shall come into operation twice or more between every binding.

2. The employment in looms for weaving of rods or spindles situated within the loops formed at the sides of the fabric, for the purpose of acting as temples, and keeping the cloth at a proper degree of tension.

3. The employment of rods or spindles, situated as aforesaid, for the purpose of causing looped or piled fabrics to move in a parallel direction during the cutting operation.

JOHN PLATT, of Oldham, engineer. *For certain improvements in machinery or apparatus for spinning and doubling cotton, and weaving cotton, flax, and other fibrous substances.* Patent dated December 2, 1850.

Claims.—1. In "self-acting mules," certain apparatus for coupling and disengaging the front roller-spindle and the drawing-out shaft, and a method of applying, clearing or scavenging rollers to the roller-beam and carriage top.

2. In the "twiner," or "self-acting doubler," a method of actuating the drawing-out shaft and tin-roller shaft by suitably disposed gearing; a method of actuating the escape lever of the cam shaft so as to produce the different required effects; and an arrangement for dispensing with the quadrant and "locking" the yarns in front of the creel carriage.

3. In machinery of this description as applied to wool, an arrangement of bevel pinions and catch-boxes for drawing in the carriage for a short distance previous to putting in the twist, in order to allow for the consequent contraction of the yarn.

4. In looms for weaving, a peculiar construction of click for working the taking-up motion; and a method of causing the tension of the cloth (produced by passing it over an additional roller placed above the cloth roller) to bind it between the cloth roller and taking-up roller, so as to effect the taking-up without employing emery-covered or other similar rollers.

THOMAS WATSON, of Rochdale, hat-manufacturer. *For improvements in the manufacture of hat plush, and also in machinery or apparatus employed in such manufacture.* Patent dated December 2, 1850.

The first branch of these improvements has special relation to that description of hat plush in which the pile is produced or raised by heating, after the fabric has been woven, and consists in employing in the manufacture thereof spun silk, of any colour or description, dyed in the hank, *i.e.* after spinning, and previous to weaving; the effect produced being far superior to that of plush manufactured in the ordinary manner, and dyed in the piece before raising.

The second branch includes an arrangement of apparatus for finishing raised pile plush, in which Mr. Watson claims specially the employment of a heated surface worked in conjunction with calender and velour rollers.

JEAN PAUL GAGE, of Paris, chemist. *For improved chemical compounds for tissue bandages, wafers, and also for surgical purposes.* Patent dated January 31, 1851.

Mr. Gage produces what he calls a "vegeto-metallic" tissue by mixing resins or resinous gums (such as gutta percha, India rubber, &c.) and granulated or laminated metals, or blades of metals, capable of exciting electric action, the effect of which is in some cases increased by immersing the tissue in vinegar and water, which is requisite, more especially for surgical purposes; when the tissue is intended for the manufacture of wafers, it is sprinkled with granulated metal, and cut into small discs of a suitable size, which are to be warmed before being applied to the letter requiring to be sealed.

Claims.—1. The chemical compositions described.

2. The various vegeto-metallic tissues resulting from these compounds.

3. Their application to the treatment of diseases.

4. The vegeto-metallic wafers described.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Thomas Parker, of Leeds, York, broker, for improvements in machinery for opening, cleaning, and preparing fibrous substances, and for manufacturing felted fabrics. June 3; six months.

John Hopkinson, of Oxford-street, Middlesex, piano-forte manufacturer, for improvements in piano-forts. (Being a communication.) June 3; six months.

William Bridges Adams, of Adam-street, Adelphi, Middlesex, engineer, for certain improvements in the construction of roads and ways for the transit of passengers, of materials, and of goods; also in buildings and in bridges, and in locomotive engines and carriages; parts of which improvements are applicable to other like purposes. June 3; six months.

Cornelius Alfred Jaquin, of New-street, Bishopsgate, London, mechanist, for improvements in the manufacture of nails, pins, tacks, screws, and other similar articles. June 3; six months.

Isaac Hazlehurst, of Marton, Dalton, Lancaster, steel refiner, for certain improvements in the manufacture of iron. June 3; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
June 2	2831	W. J, and J. Garforth	Duckenfield	Steam boiler or generator.
3	2832	J. Young	Wolverhampton	Sash axle-pulley.
4	2833	J. Steadman and Co.	Bristol	Ventilating hat.
,,	2834	A. Hurrock and J. Slate	Peterborough; Islington	Glass frame for railway and other carriages.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
June 2	228	W. Eades, Jun	Birmingham	Screw-stock.
,,	229	L. Gaviolo	Hunter - street, Brunswick - square	Pendulum escapement for a clock.
,,	230	L. Gaviolo	Hunter - street, Brunswick - square	Chronometer escapement.
,,	231	S. Dumoulin	Paris	A corset without gusset.
,,	232	T. Dossetor	Poultry	The epaulette brace.
,,	233	W. Wade	Sunderland	Stirrup bridge for lady's saddle.
,,	234	R. M. Nunn	Wexford, Ireland	Hydrometer.
3	235	H. Miles	Hackney	Combined loo-table and safe.
,,	236	R. A. Peacock	Slyne Lodge, near Lancaster	New configuration or design for the construction of culverts for railways and other engineering works, and more especially for sewers for the drainage of cities, towns, and other places and districts.

CONTENTS OF THIS NUMBER.

Duckworth's Machine for Preparing and Shaping Chicory.—Specification —(*with engravings*) 441
Naval Architecture—White and Griffiths' Treatises—(*review continued*) 444
Mathematical Periodicals. By T. Wilkinson, Esq. 449
Description of a Self-acting Distance Register for Cabs. By George Maugham, C.E —(*with engravings*) 450
Fincham's "History of Naval Architecture."—Reply of Dr. Woolley to Mr. Fincham 451
On the Construction of Steam Boilers and the Causes of their Explosions. By W. Fairbairn, Esq., C.E., F.R.S.—(*continued*) 453
Specifications of English Patents Enrolled during the Week:—
Woods ... Paving 456
Bancks ... Paper-making 456
Elmslie and Simpson ... Sheathing, &c. 457
Anderson ... Spectacles 457
Borie ... Bricks 457
Blakemore ... Ploughs 457
Burt ... Window Blinds 457
Ainslie ... Brick-making 458
Ritchie ... Stoves 458
Barber ... Reels 458
Cunningham ... Reefing Sails 458
Rowley ... Dress Pins 458
Chabert ... Washing and Drying 459
Shiers & Hegiubottom ... Textile Fabrics 459
Platt ... Spinning, &c. 459
Watson ... Hat-plush 459
Gage ... Chemical Compounds 459
Weekly List of New English Patents 460
Weekly List of Designs for Articles of Utility Registered 460
Weekly List of Provisional Registrations 460

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1453.] SATURDAY, JUNE 14, 1851. [Price 3d., Stamped, 4d.

Edited by J. C. Robertson, 166, Fleet-street.

CAPTAIN CARPENTER'S PATENT DUPLEX PROPELLER AND RUDDER.

Fig. 2.

Fig. 1.

Fig. 3.

CAPTAIN CARPENTER'S PATENT DUPLEX PROPELLER AND RUDDER.

Captain Carpenter, who is known to have been assiduously engaged for several years in experimentally investigating the conditions most essential to success in screw propulsion (*See* vol. xxxiv., p. 258, and vol. xlix., p. 223) has now patented an arrangement which may (we presume) be regarded as embodying the sum of the practical wisdom he has acquired on the subject. In an explanatory paper which he has put into private circulation—he observes, that "The experiments which have been hitherto made with the screw-propeller"—meaning not by himself, but by others—"amount to little more than testing a single screw in one position." This is quite true; and it is with no surprise we read farther that his own investigations, "tested in various ways," have led him to the conclusion that "a pair of screw propellers (suitably placed) will give more speed than a single screw," besides several other collateral advantages. With the double propeller, however, Captain Carpenter considers it essential to combine a double rudder; that is, he would have two propellers and two rudders acting in parallel planes.

Fig. 1 is a view of the stern of a screw steamer as thus constructed; fig. 2 a side-elevation of the same; and fig. 3 a bottom plan or horizontal section through the propeller shafts. From the midship section of the vessel to the stem, no change is introduced into the form of the hull; but abaft this point the alterations commence. First, the keel, with the dead-wood, stern-post, and rudder, are removed, and the flooring above receives a suitable form for strength. Two additional keels lie in a line parallel with the former keel, but placed at a distance of two or more feet, according to the size of the vessel, on either side of it, terminating at the midship section in the fore-part, and in a line with the former stern-post in the after part. Framework is carried down to these keels, leaving a free channel for the water to run between them in the direction of the midship keel. A stern-post is placed at the end of the additional keels, and upon each of them hangs a rudder. A screw-propeller works in an orifice in each framework, on the common arrangement. One of the propellers is a little more aft than the other, to allow full play to both, and yet economise space in the mid-channel. The appearance of the vessel in the water is not altered in the side view, neither is it much changed in the stern view.

The advantages of this double propelling and steering arrangement, Captain Carpenter considers to be these:

"1st. More command over the vessel with the rudder: because the angle formed between the line of centre of the vessel (that is the keel in front), and the outer edge of the rudder is greater than when the rudder is in the centre of the vessel.

"2nd. More speed: because we find that it has increased in the proportion as 21 is to 13, comparing it with a single screw-propeller placed in the dead-wood position of the same model and using the same power; and it should be borne in mind that whatever power can be applied effectively to a single screw, the same amount of power can be applied to each of the other two, which gives a double advantage in propelling on that principle. (Superior speed is essential in a war-steamer, for without it she can neither come up with the enemy nor protect a convoy against fast steamers.)

"3rd. Quicker starting and stopping: which can be detected by the eye. This advantage arises from two propellers having more hold in the water, and therefore there is less slip.

"4th. Economy in fuel and in the wear and tear of the engine; because a single engine and propeller can be used occasionally as an auxiliary to the sails, and when full power and speed are required the two can be used with less slip.

"5th. From the new form a vessel will assume in the after section, she will hold a better wind, there will be more cabin room, more strength, and less rolling and pitching. The propellers can be raised out of the water in the same way as they are with the single screw, and the two rudders can be used either separately or together.

"6th. In ships of war, two propellers and two rudders to rely on are desirable, because a vessel fitted with a single screw would be sure to get it entangled with ropes and wreck falling overboard from the first broadside, which would disable her,

while with a pair one would be kept in reserve; and if one rudder should be shot away, the other could be used."

In corroboration of the soundness of his views, Captain Carpenter adduces the following facts:

"From the *Banshee* having engines which can be worked up to 1,400 horses power, it is evident that we can have sufficient power for driving two propellers at double the effect of a single one, and from the fact also that the French screw-packet at Dover has a speed little inferior to the *Vivid*, which is the fastest vessel in the Channel, and as she is fitted with a propeller with three vanes, which has been fairly tested against the present plan, and we find the difference to be nearly in the proportion as before named; it follows that when a pair of propellers have been applied to a steam-vessel of the dimensions of the French packet, and placed precisely in the same way as they are on this model, that we shall have a speed superior to the *Vivid*, and probably we may be able to get over to Calais from Dover in sixty-five minutes. The *Vivid* has gone over in eighty minutes, and the French steamer in eighty-five minutes.

"Again; we know what the *Arrogant* steam frigate can do with a single propeller, and by comparing her performance with the large transatlantic paddle-wheel ships, we find that she cannot average the same uniform speed as they do, which can be rectified by a pair of propellers. Also, we are able to compare the performances of the *Fairy* with the small paddle-wheel steamers on the river; and we find that she cannot stop, or start, or manœuvre so well as they can, and there is a great deal of slip, from the screw not being properly immersed, and not having sufficient area to supply the required resistance. These defects can also be rectified by a pair of propellers.

"By such comparisons we are enabled to judge of the value of one plan as compared with another.

"The propeller with two vanes, which is now in general use, was first advertised and then tried on a vessel in 1839, at my own risk and expense, purposely to remove the doubts entertained by the Government engineer of its capabilities from seeing its performance only on a model, and to bring it, if possible, into action.

"As the power of that instrument is now established, there cannot be much risk in making the first experiment with its new application, which it is believed by many practical men will open a new era in steam navigation, and we shall build no more steamers for paddle-wheels, or a single screw, after it has been fairly tested on a large scale."

We conclude, by laying before our readers some able observations on the general subject of screw propulsion, and on the merits of the Duplex Propeller in particular, with which we have been favoured by a nautical gentleman who has witnessed a good many of Captain Carpenter's experiments, and is well qualified, by his own acquirements and experience, to form a sound judgment respecting what he has seen:

"The various screw propellers which have been used have each of them been useful in opening the mind to a clear understanding of that principle of propulsion, although they have always been imperfectly applied. The simple screw, placed in a direct line with the keel, is in every respect convenient as an auxiliary power, at the same time it is working to a great disadvantage; for the slip is very considerable, and in pitching there is also a great waste of power. Now I always consider *slip* nothing short of waste of fuel and time; and if you can save the power wasted in that way, the screw principle is to be preferred to the paddle-wheel.

"The only reason why the screw principle has not been adopted on the river Thames, is on account of the *slip* of the single screw, and also not being able to manœuvre as well as in paddle-wheel steamers. These objections, I imagine, are very much overcome by the Duplex rudder and propeller, because the double surface of vanes will enable a screw vessel to *stop* and *start* as freely as paddle-wheel steamers, and the slip will be very much overcome. The two rudders will enable a steam-boat to manœuvre better than the present steam-boats, judging at least from the effect I saw produced on the model. I have no doubt whatever that when the double propeller is applied to our steam-boats on the river, in the way shown in

Captain Carpenter's model, that the screw principle will be found to be very superior to everything else: in short, I feel sure that it only wanted the present opportunity to make it nearly perfect.

"It seems quite clear, from Captain Carpenter's experiments, that the screw propeller has been very carelessly applied to our ships of war, as there is a proportion which the power of the engine must bear to the diameter and area of a screw propeller, which cannot be deviated from without sacrificing speed and wasting the power of the engine. The way Captain Carpenter made some experiments, which I had the pleasure of witnessing, was as follows:—By an arrangement of his engine, which is actuated by clockwork, he had four distinct powers at command, one being double as much as the other (1 is the least power, and 4 the greatest). He first took No. 1, and applied it to a propeller of the largest diameter that can be placed in the deadwood position, and noted the speed and number of revolutions it made in going the distance of the water in the Polytechnic Institution. He then gradually reduced its diameter, keeping the angle the same at the extremity of the vanes till it showed a decided loss of speed, noting down the results. He next went through the same process with 2, 3, and 4, and noted the results down. He then went through a series of experiments in the same way with the Duplex rudder and propeller, by which means he was able to ascertain the effect heat produced under every circumstance, and also how the speed varies in proportion to the power. The results were very curious. With power No. 1, and largest sized propeller, the speed was very slow; with the smallest size, it is almost all slip; but with the best proportion it was very fair. The speed gradually increased with the power, but not in the ratio it might be supposed. The two propellers effected the best speed with a less diameter of propeller than the single one; but when power No. 4 was applied to one of those propellers placed in the deadwood, the speed was as 21 is to 13.

"The greatest speed that can be produced on the model is by using a single vane on each shaft, with a middle-sized propeller; but the difference between the single vanes and the double is very small, and the waste of power is very great with the former.

"It seems to me, judging from all these experiments, that the best mode of propelling vessels is by using two propellers on two separate shafts, as it is shown on Captain Carpenter's model, each propeller having two curved vanes set vertical on the shaft to its plane, standing on the boss at an angle of 22°, and curved up to the extremity of the vane gradually till it arrives at 67½°.

"There is evidently economy in giving increased revolutions, in preference to having a great diameter to effect speed and save time and fuel.

"The slip of a single screw is considerably more than a double one.

"The difference between two screw propellers and a single screw in gain and loss may perhaps be explained thus:—Suppose it to be necessary to bore two holes in a piece of wood, and that the man who bores one hole finds it requires all his strength to do so; as a matter of course, it would require all the strength of a second man to bore the second hole. This is, supposing both men were obliged to turn the instrument at the same time, and with the same number of revolutions; but this is not the case with the fluid, nor perhaps a ship, because if the man who turns the first screw finds that his power is just sufficient to move the vessel, it only requires a force in the other man just enough to overcome the friction in the shaft, and the resistance of the edge of the vanes of the propellers, for the vessel will go on with the power of the one man if the other is idle, supposing he just turns his screw enough not to retard the other. Now, supposing the man who before was idle, puts all his strength into the other propeller, he is relieving his companion of half his work, or nearly so, and the vessel will proceed forwards in due proportion. In the same way does it apply to the steam engine.

"For example; supposing the *Banshee* to be fitted with her former power of 1,400 horses power, it is quite evident that 700 would have been sufficient to work a single screw till it began to churn the water. If, therefore, the other propeller were set to work, it would advance the vessel, because the two would not slip when the single one would. In crossing the Atlantic with a single screw propeller, as the vessel must pitch, it is quite clear that every time the vanes come out of the water it is so

much waste of time and fuel. Now, the Duplex propeller would pick up the power that is lost in that way. I therefore cannot conceive why the merchant who wishes to economise time and fuel should use a single propeller when he can use two.

"The construction of a vessel on this new plan has also to be considered. I imagine that the water contained in the new channel will act like a wedge in keeping her from rolling or going to leeward; for it is evident that if she rolls that the water contained in that space must roll *with* her, for it cannot break off like a solid; in fact, the water on the outside will prevent it, therefore the rolling will be diminished, and she must hold a better wind. Whether she would go so fast in sailing I cannot pretend to say—that has yet to be tried; all I feel sure of is, that speed will not be diminished in steaming.

"Ship-builders say that there will be great economy in the timber, and that a vessel may be thus strengthened considerably. The bearings will certainly be increased, and these seem to be the main points we have been searching after.

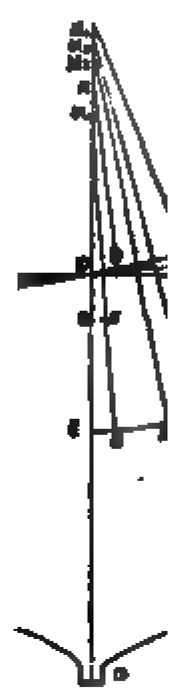
NAVAL ARCHITECTURE.—WHITE'S AND GRIFFITHS' TREATISES.

(Review, continued from p. 446.)

The time of oscillation of a vessel is evidently a question of great importance to the constructor. Considerable difficulties attend the accurate investigation of this element. Professor Moseley has very ingeniously applied the properties of the surface of flotation, which M. Dupin very elaborately investigated, to its determination. Although his labours in this inquiry are deserving of great praise, and are of great service in setting clearly before the student the *axis* about which the ship is actually rolling; yet when the actual mathematical investigation has to be made, it is necessary to introduce so many suppositions in order to make the equation at all integrable, that no greater accuracy is obtained by this than by previous methods.

This will be made sufficiently apparent by considering the nature of the surface of flotation. In the figure, let EHS be the locus of the centres of buoyancy; let H, H^1 be two consecutive points indefinitely near to E.

In passing from E to the consecutive point H, the planes of flotation AB, PQ, intersect in a straight line through C, the common centre of gravity of these two planes; and we obtain *one* point, C, in the surface of flotation, while we obtain also



the point M, the intersection of the consecutive normals at E and H. In passing from the point H to H_1, we obtain a second point O in the surface of flotation by the intersection of the two planes PQ, P_1Q_1, and a second point M_1, where the normal

at H_1 cuts CD;—C and O being consecutive points in the surface of flotation, the normals CR, OR intersect in R the centre of curvature of this surface at the point C. Now, in order to integrate his equation, Professor Moseley is obliged to suppose the point R to be that through which all the normals to the surface of flotation for the whole amplitude of the vessel's oscillation pass—which evidently allows the metacentre M only to travel as far M_1, a consecutive position.

In vessels of the best shape this supposition is doubtless not very far from the truth; but it is important to test the accuracy of the assumption. Professor Moseley's formula for the time is

$$t(\theta_1) = \frac{\pi k}{\sqrt{g\left(\frac{\mu A}{W} - d\right)}} \left\{1 + 4\,\frac{(H_1 \pm \rho)^2 + k^2}{4k^2}\,\sin.^2 \frac{\theta_1}{2}\right\}$$

where k is the radius of gyration, H_1 the depth of the centre of gravity of the ship below the water-line, ρ the radius of curvature of the surface of flotation (in the figure CR), μ the weight of a cubic foot of water, A the moment of inertia of the plane of flotation about an axis through its centre of gravity parallel to the axis about which the vessel rolls, and d, as usual, the distance of the centre of buoyancy from the centre of gravity, and θ_1 the amplitude of the oscillation on *one* side of the upright position.

On neglecting the second term in the bracket as very small compared to unity, he gets approximately

$$t(\theta_1) = \frac{\pi k}{\sqrt{g\left(\frac{\mu A}{W} - d\right)}}.$$

Now in the figure, if GZ be drawn from G perpendicular on HM;

$$GM = \frac{\mu A}{W} - d$$

by the well-known property of the metacentre. If, therefore, we suppose the vessel to describe any angle with a moment of stability varying as its angular distance from the upright position; the moment of the force tending to bring the vessel back will be represented by $(\mu A - Wd)\,\theta$. Hence by D'Alembert's principle:

$$\frac{d^2\theta}{dt^2} = -\frac{g}{Wk^2}(\mu A - Wd)\,\theta;$$

whence if θ_1 be the extreme angle of oscillation,

$$t_{\theta_1} = \frac{\pi k}{\sqrt{g\left(\frac{\mu A}{W} - d\right)}}$$

as before. This agreement is just what we should have expected from the considerations we have offered above.

It may happen that if the vessel oscillate through a large angle, as is sometimes the case, the normals to the various points of the locus of the centres of buoyancy will by no means approximately pass through M; the oscillations will then cease to be tautochronous.

In the figure above referred to let H, H_1, H_2, H_3, H_4, be several points in this curve, M, M_1, M_2, M_3, M_4, the several points where the normals at these points cut the vertical line DC. Suppose the moment of stability calculated for each of these positions of the vessel; let a, a_1, a_2, a_3, a_4, be the corresponding angles from the upright; and M_a, M_{a_1}, M_{a_2}, M_{a_3}, M_{a_4}, the corresponding moments of stability. Now, on comparing these, it will be found that in general they follow no certain law.

Let us suppose, however, the stability in any position varies as the angle to be described to the upright position; and let the vessel start from the extreme angle a_4 with the absolute stability at that point M_{a_4}. Then we have the equation

$$\frac{Wk^2}{g}\,\frac{d^2\theta}{dt^2} = -M_{a_4}\frac{\theta}{a_4} \quad (1.)$$

whence t_{a_4} (time of oscillation)

$$= \frac{\pi k}{\sqrt{g\frac{M_{a_4}}{W_{a_4}}}}.$$

If the moments of stability on this suppo-

sition at the intermediate points be *too great*, it is evident that this time is less than the actual time of oscillation of the ship. Now, suppose the vessel to oscillate through *the same angle* with a moment of stability varying as the angle as before, but its *actual* amount so altered that at H_8, its value be strictly that corresponding to that position. Then the stability at H_4

$$= \frac{M_{a_8}}{a_8} a_4;$$

and hence the equation (1) becomes

$$\frac{W}{g} k^2 \frac{d^2\theta}{dt^2} = -\frac{\mu a^8}{a_8} a_4 \cdot \frac{\theta}{a_4} = -\frac{\mu a_8}{a_8}\theta \ ..(2).$$

Hence, calling t_{a_8} the corresponding time of oscillation

$$t_{a_8} = \frac{\pi k}{\sqrt{g\frac{\mu a_8}{W a_8}}}.$$

Proceeding similarly with the absolute stability of each of the other points H, H_1, H_2, &c., using the same notation we have

$$t a_2 = \frac{\pi k}{\sqrt{g\frac{\mu a_2}{W a_2'}}},$$

and so for the rest. And, lastly, supposing the vessel to roll through the whole angle with the absolute value of stability given by the metacentre, and calling t_0 the corresponding time

$$t_0 = \frac{\pi k}{\sqrt{g(\frac{\mu A}{W} - d)}}.$$

Now, evidently, some of these times will be greater and some less than the absolute time of the ship's oscillation, which may be approximately taken to be the mean of all of them.

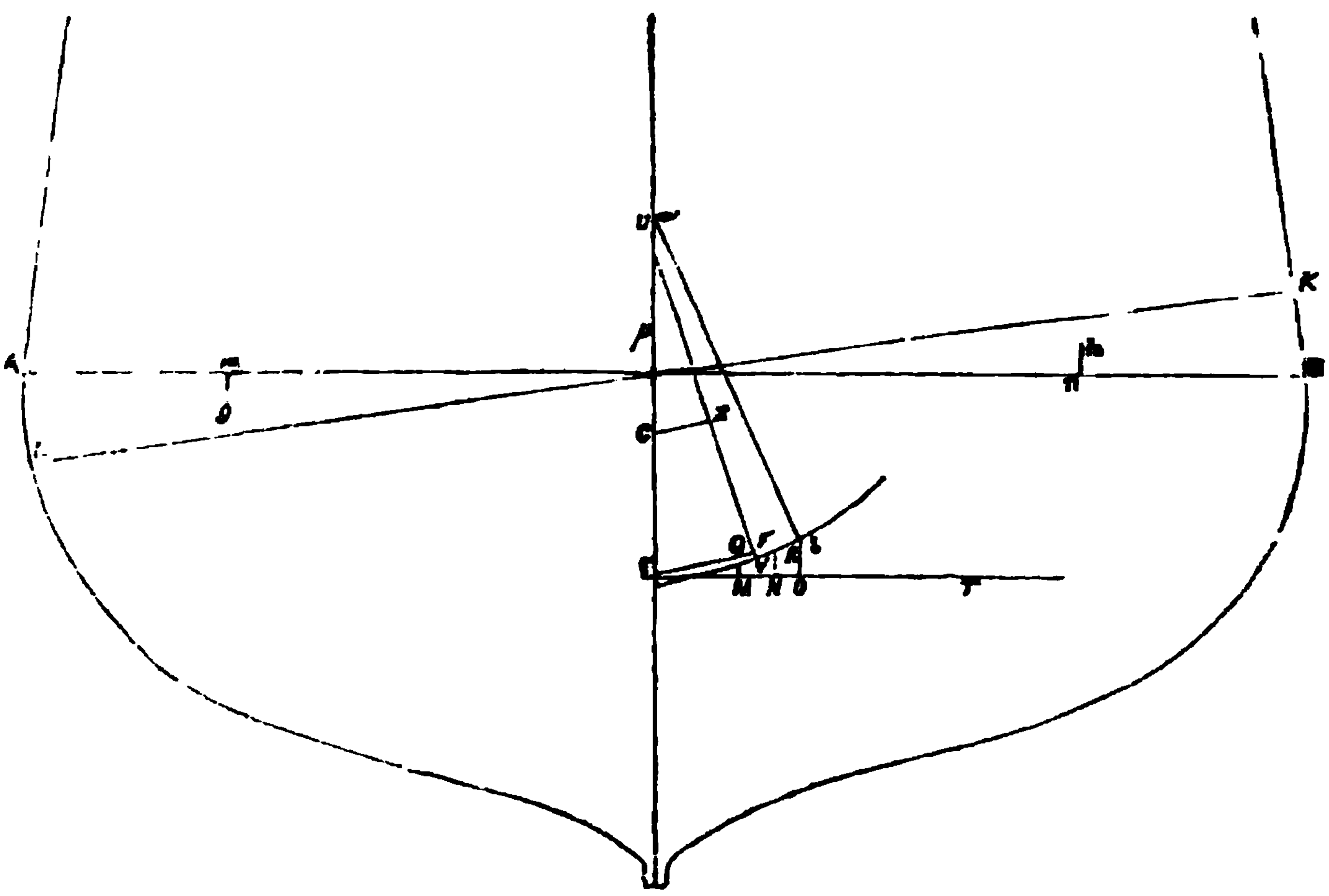
Hence if T be the time, and the number of times t_0, t_{a_1} &c., be n, we shall have

$$T = \frac{t_0 + t_{a_1} + t_{a_2} + \&c. + t_{a_4 - 1}}{n}$$

if this differs little from t_0, then t_0 may be *generally* taken as the time of the ship's oscillation. But it is evident that the time thus found will generally be a much nearer approximation to the true value than that given by the stability corresponding to any single angle.

In vessels of the more usual forms, it is perhaps generally true that within the limits to which their oscillations are usually confined, the time of oscillation is independent of the amplitude. This may not, however, always be the case; and the investigation we have just given will then determine the time corresponding to any particular amplitude with sufficient correctness. It would enable the constructor to obtain a very tolerable notion of the qualities of his proposed vessel with regard to stability, &c.; if the locus of the centres of buoyancy were approximately drawn in on his construction draught. If there be no sudden alteration in form in the neighbourhood of the water-line, so far as it is subject to immersion and emersion, this curve will be continuous, and present a practically little difficulty to its being drawn with a very considerable degree of correctness. It would be sufficient to limit this curve at the point corresponding to an angle of 20°, or at most 30° of inclination of the ship. The whole length between the extreme points would in general not be very great; a very few points, therefore, will enable the draughtsman to run it off, especially as he is aided by the consideration that the tangent at each point is parallel to the water-line, which will serve him as a guide to the curvature at each point.

In the figure, suppose EQRS to be the curve; let S be the centre of buoyancy when the vessel has heeled through 24°; Q and R the centres corresponding to the angles 8° and 16°. By the usual method, the spaces EM, MQ parallel and perpendicular to the original water-line ACB, through which the centre of buoyancy moves by the vessel's heeling through 8° may be calculated, and the point Q found. Thus, if LK be the water-line at 8° of inclination; g and h the projections on the plane ADB of the centres of gravity of the wedges of which LOA, BOK are the bases;



mg, nh perpendiculars on AB; and if W = weight of the vessel, and w = weight of either wedge AOL, BOK, then

$$EM = \frac{w.mn}{W}, \text{ and } MQ = \frac{w(mg + nh)}{W},$$

$w.mn$ and $w(mg + nh)$ the horizontal and vertical moments of the wedges AOL, BOK must be found by the common rule.

In the same way the points R and S may be found. Now, through Q, R, S, draw lines inclined to the vertical CD at angles of 82°, 74°, and 66°, respectively, these are tangents to the curve required at the points Q, R, S; the tangent at E being the horizontal line ET. The draughtsman must now draw his line through those points, taking care to make it touch the tangents just drawn at E, Q, R and S, the resulting curve will be a very close approximation to that actually described by the centre of buoyancy. Having this curve, he may find the stability, whether statical or dynamical, at any other inclination. Suppose, for instance, he requires it at 12°, he can readily find the point V, at which a line inclined to the vertical CD at an angle of 78° touches the curve EQS. V is the centre of buoyancy at that inclination. Draw V U perpendicular to the tangent at V, and from G draw GZ, perpendicular on VU. Then the statical stability = W.GZ = W.GU sin. 12°; GU may be measured on an accurately divided scale. Also draw EF parallel to the tangent at V. Then W.VF − W.EG vers 12° is the measure of dynamical stability at the same point; and VF may be readily found by the scale. It would be convenient to find μ the metacentre, and then draw Sσ, the normal to the curve ES at the point S; it would be easy to judge by the distance of σ from μ, whether the oscillations within the given limits might be considered tautochronous or not. It is evident, *cæteris paribus*, that the constructor must aim at getting all the points where the normals to the locus of the centre of buoyancy intersect the vertical line CD as near to μ as possible. When this is the case, the surface of flotation will generally be of small extent, and nearly circular, and the normals to it will also generally pass through one point nearly.

Now there are two forms of vessels, which enable us to fulfil these conditions; one where the athwart-ship sections about the water-line are for a considerable extent circular, and the other where the sections are of a rectangular form. The best vessels we accordingly find approximate to these forms; we may mention the *Canopus* as belonging to the former type, and the *Thetis* to the latter. There is another reason why these forms should characterise the vessels to which

they belong as good. It has been observed that the centre of gravity usually rises in a vertical line, and the vessel *slides* as well as *rolls* on the surface of flotation; the axis, therefore, about which the vessel is rolling is obtained by drawing perpendiculars to the vertical through the centre of gravity (parallel to the plane in which the ship is rolling), and to the water-line through the corresponding point of the surface of flotation. Now, it is evident that the *less* this axis varies in position the *more easily* will the vessel roll. The variation of this axis will evidently depend chiefly on the *magnitude* of the surface of flotation. The forms we have above described as characterizing the *Canopus* and *Thetis*, give rise to the smallest possible extent of surface of flotation. Hence these vessels would on that account roll easily; a property, we believe, which they both eminently possess.

While we are on this subject, there is another point in which science comes to the assistance of practice, which we may do well to mention, especially as we have not seen it noticed before. It is this—that all sudden changes of form in the vessel between wind and water, *i.e.*, in the portions subject to immersion and emersion should be carefully avoided. It will generally arise if this caution be not observed, that the *elocity of the centre of gravity*, corresponding to different degrees of inclination of the vessel, will be subject to sudden and violent changes; and the vessel descending or ascending bodily with a certain amount of *vis viva* will be suddenly checked, and this *vis viva* destroyed or very materially diminished; whence must result shocks injurious to the fabric, and very disagreeable to those on board. We believe that in several of Sir William Symonds' ships attention has not been paid to this circumstance; and that the inconvenient results we have described have been the consequence. It is not difficult to obtain an equation connecting the motion of the centre of gravity with the angular motion of the vessel. The constructor would do well to examine the terms on which the ratio of these motions depend, with an eye to provide against too sudden changes in its amount.

There are various deductions applicable to the practice of ship-building which follow from the true theory of stability, some of which were observed by Euler and others, and some are of comparatively late date. Thus, that the centres of gravity of the wedges subject to immersion and emersion should lie in the same athwartship plane with the centres of gravity and buoyancy, or at least not deviate far from it, was observed by Dr. Inman, and has since been confirmed by the reflections of Professor Moseley; for it is evident that if these centres of gravity travel in a fore-and-aft direction, the centre of buoyancy must have a similar motion, though in a reduced degree; the result of which must be a pitching, combined with a rolling motion. Thus also Euler observed, that if two vessels were of exactly similar forms, similarly equipped with masts, sails, &c., the larger one ought to be more stable than the smaller. To Professor Moseley we owe some very valuable remarks on the synchronism of the vessel's oscillations with those of her masts, resulting from their elasticity. If these oscillations do not synchronize, he has pointed out the fact that there must be a strain upon the vessel which is highly injurious to her coherence. In determining the time of oscillation of a vessel, therefore, great attention should be paid to this point; and as vessels of the same class are usually masted in the *same way precisely*, we should require only to know the time of oscillation of a vessel in which this synchronism holds, to determine this element for other vessels of the same class. We cannot dilate longer on the *practical* inferences which arise immediately from the theory of stability—not, perhaps, as Mr. Griffiths has propounded it, but as it comes at last from the laboratory of European science, having passed through the crucible of several centuries. That Mr. Griffiths and his friend, Mr. David Brown, are not very happy in their strictures on the labours of scientific men in this department, we have stated enough, we trust, to convince the thoughtful, practical man of this country.

We have pointed out practical principles of construction, deduced from theory and confirmed by experience, which, properly understood, would serve as most useful beacons and landmarks to naval constructors. The greater part of what we have said, however, is evidently utterly unknown to Mr. Griffiths; and it is painful and disheartening to turn from the beautiful theories we have been presenting to our readers, though in a very condensed form, to the vague, unintelligible, and erroneous statements with which the work which the *New York Scientific American* does not scruple to call "The Book of Naval Architecture" abounds. It is a task which we would gladly have spared ourselves; but our duty to our readers demands that we do not shrink from it, especially as we hope that our cousins across the Atlantic may have the opportunity, through our columns, of contrasting *true* and *false* science. We shall content ourselves with a few extracts, without comments; and with them take leave of so much of our author's work as relates to stability.

Page 35, we read:—"A second axiom may be deduced from this law of equilibriated gravity in bulks, in the seeming paradox that the centre of gravity is not the centre of motion. In all bodies floating on fluids, and only partially immersed, the *line* or *point* of support has a separate and distinct location, unless, as before stated, the body is homogeneous in shape and of equal density; in such case it has instability. It will appear quite manifest, upon a moment's reflection, apart from conclusions drawn from mathematical investigations, that a body having its *centre of gravity* depressed below its *vertical centre*, and suspended by a point above the *vertical centre*, such body would be subject to less oscillatory motion than if suspended at the centre of gravity." (What *is* the meaning of all this?) Again:—"It is a conceded point—a truth with which all are familiar—that all bodies are supported by the centre of gravity, and that it requires a force more than equal to the entire weight of the entire bulk to lift that body when applied to this centre; and that the body thus suspended has no stability, but revolves about this centre. Not so, however, with a body or vessel floating on a fluid, and sustaining the pressure *of two elements*; the centre of gravity loses its influence as a point of support, because the fluid beneath is non-elastic, and of greater density than the fluid above. Thus it is plain that the forces of the fluid upward *must exceed the forces of the fluid downward, or there is no stability.*" Again, page 37:—"The equilibrium of fluids should teach us this truth—that the *pressure of the fluid*, or the *direction* of the resistance, is at right angles with the surface of the body, or the exterior surface of the cavity of the vessel; hence it follows that, to find the centre of effort (metacentre) of a floating body, is to find the centre of that force *enabling a ship to preserve an equilibrium perpendicular* to the surface of the fluid by which she is sustained." Again, page 39:—"This leads us to another proposition: neither the centre of effort, nor the centre of cavity, or the centre of gravity, *is* the oscillating point or fulcrum upon which this stupendous fabric moves. When the *centre of gravity is located below the surface of the fluid*, the oscillating point is found at the surface; but when the centre of gravity is *at the same* or a *greater altitude*, itself becomes the oscillating point, AS ALL BODIES ABOVE THE SURFACE OF THE WATER OSCILLATE UPON THAT POINT." We shall conclude with our author's VERY LUCID representation of these points by the analogy of a scale-beam,—let who can understand it:—"The several centres may be represented by the ordinary store-keeper's scale beam: upon the nail or point of suspension depends the weight of the scales, weights, and articles weighed. This point is at a greater altitude than the fulcrum upon which the beam oscillates, while the scales in their distended capacity are found still lower. So with those points of measurement of stability; the centre of effort, to which is delegated the power of contending with a combination of forces emanating from two elements, is the highest power. The *fulcrum* or *oscillating power*, or *centre of motion*, is located at the surface, as the fulcrum is at the surface of the beam; while the centre of cavity and centre of gravity take their places, like the scales, at less elevated positions." After these very *lucid* and *original* explanations, we need not inform our readers that the mathematical investigation of stability is of the most meagre and unsatisfactory kind.

(*To be continued.*)

DESCRIPTION OF THE GEOTROPESCOPE, OR APPARATUS FOR ILLUSTRATING THE PRINCIPLE OF FOUCAULT'S EXPERIMENT, INVENTED BY DR. E. HENDERSON.

Sir,—I send you a perspective view of a simple apparatus which I have lately contrived, and just had made, for illustrating in a popular manner the *principle* of

the Foucault experiment demonstrative of the visible rotation of the earth on its axis. I call it the Geotropescope, *i. e.*, to see the earth turning. I shall first

describe the instrument, and show its use. AA represents a kind of thin circular box, turned out of a solid piece of hard wood, which is about ten inches in diameter and one inch deep. Within this there lies, like a lid, the circular disc of turned wood BB, having a polar projection of the world laid down upon it, and on the under side of it, and precisely in the centre of it, there is made fast a contrate brass wheel, which is connected with a horizontal pinion, on the extremity of which is fixed the handle H. By turning this round, motion is communicated to the disc BB, which is caused to make a revolution, carrying along with it the strong wire which is secured to its surface, as also the miniature table T. The wire C ascends to the height of about eighteen inches in a perpendicular direction; it is then thrown over in the form of an arch, as shown in the figure, and terminates in a kind of hook D, from which is suspended by a fine thread the weight W, having a steel pointer P projecting from under it: this point, when at rest, is directly over the centre of the little table T. These are all the parts requiring to be described. Now for the application of its motions illustrative of the earth's rotation:

Take hold of the weight W, and draw to any of the two positions shown by the dotted lines, and be careful to let the weight fall so that it may vibrate without shake, and in a straight line; this done, take hold of the handle H, and turn it round; then the table will commence its revolution, as will also the wire C. The pointer P in its vibration will always *cut over* the centre of the small table, because it follows it in its circular motion. Suppose at starting the handle, the vibration of the pointer P, cuts through the letters A and B on the surface of the table, when by moving the handle this table makes a fourth part of a revolution, the pointer will no longer cut through, or vibrate over the straight line running across these two letters, but will point 90° distant therefrom; showing thereby that the Table alters its position to the line of vibration of the pendulum or weight W, which always preserves its direction of motion, and is therefore quite independent of the table or any other object whatever. If we suppose the surface B B to represent the earth, and T the table or circle, as first shown by Foucault, then, all the conditions implied in his interesting experiment is made manifest in a few minutes. By swinging the ball and causing the disc B B to revolve, the pendulum or weight W vibrates between two fixed points beyond the earth,—say two fixed stars; and, whilst doing so, the earth is in rotation under it, as exemplified by the machine. The rotation of the moon on its axis may be demonstrated in the same way, merely by supposing that a pendulum is kept vibrating over the moon during its revolution round the earth; the pendulum arc of vibration would always be in one direction, whilst the moon, with respect to that line, would revolve under it.

I am, Sir, yours, &c.,

E. Henderson.

Liverpool, April 28, 1851.

MR. NASMYTH'S "ABSOLUTE SAFETY VALVE."

Sir,—In your Magazine of the 31st ult., you have engraved and described Mr. Nasmyth's "Absolute Safety Valve." As the name chosen is one denoting perfection, and one on which the public (knowing Mr. Nasmyth's high standing in the scientific world) may be inclined to rely implicitly, I think we have a right to question the *correctness* of the *term*, whilst we give the fullest meed of praise to the inventor for his ingenuity.

Taking the proportions of your engraving, I conceive the "sheet iron" attachment to be a tube of 9 to 12 inches in diameter, with apertures round the top;—the proportional *length* is not ascertainable from either the sketch or description.

Has Mr. Nasmyth considered the specific gravity of the iron thus immersed?

I can readily conceive that the question has not escaped his notice; and probably he can show that to be unimportant which appears to me and to others to be a decided objection.

Supposing the length of the "sheet iron" to be 6 or 9 inches, the weight *may* be *comparatively* unimportant; but should the water fall in the boiler below the "sheet iron," then the pendulous

motion ceases; but if the "sheet iron" be long enough to reach to within a few inches of the bottom of a large boiler, so that the rocking motion may be available in extreme cases, I conceive that the *weight increasing* as the *water is decreasing* is a matter of vast importance, and deserving of Mr. Nasmyth's due consideration, before allowing the public to rely *absolutely* on his modification of one of the most important portions connected with our steam engines.

As an *additional* valve, the arrangement is doubtless good; and I am far from wishing to disparage the invention in thus pointing out what I conceive to be an error of vital importance, and one which may be readily obviated, and the specific gravity made to assist in the opening of the valve when most required, rather than be brought to bear, as it possibly may be in some cases, fatally.

Is it not worthy of consideration whether the incrustation on the tube, arising from the use of impure water, will not add several pounds to the weight? And is it not also questionable whether the "perfect spherical fit and agreement between the valve and its seat" may not become *so* perfect as to be *fixed* by less heat than an ordinary fitting valve, from which some very small portion of steam is continually escaping?

Should my position be a fallacious one, I shall be most happy to withdraw my objection; and I trust Mr. Nasmyth will be enabled to show that his "Absolute Safety Valve" is fully entitled to its appellation.

I am, Sir, yours, &c.,
WILLIAM MORGAN.

Bromsgrove, June 2, 1851.

MR. FROST'S "STAME."

Sir,—Referring you to another communication of even date with this,* and mailed at the same time, in which I have given you the results of some further experiments made by me on steam and "stame," I inclose herein a cutting from the *Scientific American*, containing a voluntary detailed experiment of a Mr. Whipple, of Westfield, Massachusets, wherein he obtained much more than twice the effect from fuel employed for stame than from fuel employed for steam, and by a very inefficient apparatus for that purpose, with a high-pressure engine.

As before stated, I have myself obtained, and can at any time obtain, much more than FOUR times the effect from fuel employed for stame than from the same amount of fuel employed for steam in a high-pressure engine, and much more than SIX times the amount of force from fuel employed for stame than from fuel employed for steam in a low-pressure engine; and I am able to show the causes of my superior attainments.

For, having experimented with many differently constructed heaters, I have obtained such different results from the different instruments as will account for the great difference between Mr. Whipple's experiments and mine.

Thus, on trial of a cylindrical heater of two diameters in length, maintained at a dull red heat, the steam passed through but little heated in its passage, if compared with the heat it acquired by passing through an equally heated coil of iron tubing, containing barely as much heated surface as the cylindrical heater contained. In fact, the cylinder had only half the heating effect on the steam.

This was a very unexpected result: it seems to have been caused by the steam taking the readiest and most direct course through the cylinder, and with but little contact with the heated cylinder, compared with the close contact it must unavoidably have taken with the heated coil of small tube in its passage therein.

From the description given of Mr. Whipple's cylindrical heater, the small effect he obtained may be thus accounted for, and a great increase of effect may be anticipated from a proper exchange and precaution.

Were I not afraid of trespassing on your columns, I could furnish you with other equally curious observed different effects obtained from different heaters of equal surfaces and equal temperatures, and have long been, and am still, experimenting practically to secure the unobjectionable combination of efficiency, economy, and durability in steam heaters—all alike and indispensible properties in a good instrument.

The same fears prevent my communicating many observations on the efficiency of several distinct forms of boilers, and

* Inserted *ante*, page 428.

unlucky attempts to realize the advantages that stame, when well understood, will secure to mankind.

I am, Sir, yours, &c.,
JAMES FROST,
Engineer.

Fulton Avenue. Brooklyn, New York,
May 7, 1851.

Mr. Whipple's Statement.

"I tried the experiment of heating steam separate from the water, in 1848, with a six horse-power engine, whereby I saved one-quarter of the wood. In 1849 I tried it on a steam boiler, 28 feet long and 2 feet in diameter, and supplied steam for a 7-inch cylinder and 15-inch stroke, with 300 revolutions per minute, with 90 lbs. of *stame* per square inch, and before heating the steam it would not make steam for a 5-inch cylinder, 24-inch stroke, 25 revolutions per minute. I have since run a one horse-power with *stame*, and found it to be a great saving of fuel. I heat my steam in a cylinder at or near the back end of the boiler.

"W. G. WHIPPLE."

EFFECT OF THE EARTH'S ROTATION ON PROJECTILES.

Sir,—Much attention has been drawn to the revolution of the plane of a pendulum in consequence of the rotation of the earth; but, to my surprise, nobody seems yet to have extended this theory to the motion of projectiles, which it seems to me must be more affected by the rotary motion of the earth equally in the pendulum. A cannon ball, for instance, on leaving the mouth of the gun is surely in precisely the same circumstances as the bob of a pendulum when leaving the vertical. The period occupied by the plane of a pendulum in performing one entire revolution in this latitude is rather more than 30 hours, or about 110,400 seconds, and if we suppose a pendulum long enough to require 30 seconds in its flight from the vertical to the extremity of its range, we have only to divide 110,400 by 30, to find what portion of the entire revolution is performed during one semi-oscillation; this appears to be $\frac{1}{3680}$th part. Now, a cannon ball may have a range of two miles, and occupy 30 seconds in its flight; it ought, therefore, on alighting to deviate $\frac{1}{3680}$th part of the 0 due to a radius of two miles,—and this is found to be about 18 feet. Generally, a projectile should deviate to the right of the vertical plane in which it is fired by a space varying directly as its range, and inversely as its speed. If you will do me the favour to publish this letter, it may probably catch the eye of some one sufficiently versed in artillery practice to say, whether it is or is not necessary to point a gun to the left of the object aimed at. It seems to me impossible that it should be otherwise; but I have never heard that such is the case.

I am, Sir, yours, &c.,
OSBORNE REYNOLDS.

Dedham, June 10, 1851.

MATHEMATICAL PERIODICALS.

(Continued from p. 450.)

No. XXVII. *The Enigmatical Entertainer and Mathematical Associate.*

Editors.—After the publication of No. 1., the addresses to correspondents emanate from the "*Editor*" only, but his name does not occur in any portion of the volume. William Godward, Esq., of London, however, kindly informs me that the work was conducted by Mr. Paul Ninnis, a well-known correspondent of the *Diaries* and several other mathematical periodicals.

Contents.—Each number of this serial, except the first, is divided into two departments, with separate pagings and appropriate, running titles. The first department is entitled, "The Enigmatical Entertainer," and includes Enigmas, Charades, Rebuses, Anagrams, Philosophical Questions, together with replies and answers to each. The second department contains Mathematical Questions and their Solutions, under the title of "The Mathematical Associate." The original intention of the Editor was to insert twenty Enigmas, thirty Charades, &c., ten Queries, and twenty Mathematical Questions in each number, but this arrangement is not strictly adhered to, so far as the Charades and Queries are concerned.

Perhaps no class of persons are so constitutionally jealous of each other as are the poets and mathematicians. The former have already been designated *par excellence* as the "*genus irritabile*," and the latter, beyond all question, have on

numerous occasions exhibited so many of the characteristics of this division of human nature, as justly to entitle them to the same appellation. The controversies relating to the discovery of the "Method of Fluxions," and "Horner's Processes," are cases in point; but it is unnecessary to particularise further, since daily experience furnishes abundant instances of the extensive ramification and the baneful influences arising from the jealous dispositions of scientific men. Such feelings have on many occasions prevented otherwise able correspondents from benefiting the community by causing them to withhold the publication of valuable researches; and in other instances their undue operation has been accessory to the violent demise of some of our best periodical publications. Mr. Ninnis was not altogether unacquainted with mathematical and literary society under these objectionable forms, and hence determined, if possible, to avoid offence by inserting the poetical contributions and the mathematical questions "*in the order of an alphabetical list of the names of their authors, except the prize enigma;*" but the "Address to Correspondents" in No. III. will show that even this arrangement failed to produce the desired results. The poetical department occupies nearly double the space of the mathematical, and contains many elegant compositions by some of the best correspondents of the period. Amongst these may be enumerated the names of Mr. Clay, editor of the *Scientific Receptacle;* Mrs. and Miss Clay; the Misses Richardson, authors of several poems of considerable merit; the facetious and witty "Noah Wilmot, S—s," *alias* Mr. Thomas Wilson; Messrs. Baines, Smart, Crossley, Gill, and Hutchinson; Mr. Charles Holt, editor of the *Scientific Mirror;* Messrs. Ninnis, Robarts; Winifred Waverton; and lastly the Rev. John Hope, the well-known linguist and laureate of the *Diary*. The philosophical questions contain many inquiries and discussions well worthy of notice, embracing biblical criticism, antiquities, archæology, classical literature, chemistry, natural, moral, and political philosophy, &c.; the principal contributors to this department being Messrs. Baines, Hope, Robarts, Herdson, Holt, Harrison, and Paxton.

(*To be resumed.*)

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JUNE 11, 1851.

JULIAN BERNARD, of Green-street, Grosvenor-square, gentleman; and JEAN BAPTISTE DUREUILLE, of 30, Cité de l'Etoile, Thermes, France. *For improvements in the manufacture or production of boots and shoes, and in the materials and machinery or apparatus to be employed therein.* Patent dated December 4, 1850.

This invention has for its object the application of machinery to the manufacture of boots and shoes. The claims include different methods of and arrangements for effecting the preparation of the leather by beating and hammering; cutting out the sole, heel-pieces, uppers, and linings, by punches; reducing or paring the edges of the latter; mounting the uppers and stretching them on the last; forming the heel from a number of pieces of leather; attaching the sole to the upper whilst the latter is stretched on the last, and the heel to the sole; cutting off the projecting ends of the tacks employed in fastening the parts together; and, finally, bevelling off and polishing the edges of the sole by revolving discs.

BENJAMIN HINLEY, of Birmingham, brass-founder. *For improvements in the manufacture of castors.* Patent dated December 5, 1850.

These improvements have relation to the method of connecting the horn of castors, or that part which carries the wheel or roller with the axis on which it turns. Mr. Hinley proposes to form the axis with grooves or with projecting parts, and to employ it as a core for casting the horn, the grooves or projections being so formed as to prevent the parts from separating, and at the same time admit of the horn having perfect freedom of motion. The axis may be formed of wrought or malleable cast iron, and in order to prevent the cast metal from cooling too tightly thereon, it is to be coated with a mixture of black lead with water or beer, and of the consistence of paint.

Claim.—The mode described of forming the axes and casting thereon the horns or parts of castors which carry the wheels or rollers.

JOSEPH ALEXANDER FRANKLINSKY, of Stanhope-place, gentleman. *For improvements in public carriages for the conveyance of passengers.* Patent dated December 5, 1850.

Mr. Franklinsky specifies

1. An improved construction of omnibus which is divided into a number of compartments, each with a separate entrance and a seat for one passenger, and partitioned off from that next adjoining it by slidingpanels.

which may be opened or closed at pleasure. In order to give ready access to the compartments, a stage or platform runs along each side of the body, and is provided with a hand-rail placed at such a distance as not to interfere with the opening of the doors. In omnibuses thus built, a degree of privacy (if desired) may be ensured, utterly unattainable in those of ordinary construction, and each passenger can neither incommode nor be inconvenienced by any of the others.

2. A street cab, with a body somewhat similar to that of a "Hansom," but divided into three separate compartments, in order to accommodate passengers who may be going different distances in the same direction. The driver's seat is, however, placed in front like that of a phæton, and is of sufficient size to accommodate two outside passengers.

No claims.

Ewald Riepe, of Finsbury-square, merchant. *For certain improvements in refining steel.* (A communication.) Patent dated December 5, 1850.

Specification.—I take bars or lumps of raw or crude steel (particularly puddled steel), and in order to the refining of them, place them in a furnace or other heating chamber, out of the reach of any injurious action upon them by the atmospheric air, and there subject them for a time to a temperature not exceeding the melting point of steel. I use for the purpose a welding furnace, such as is ordinarily employed in puddling iron, only that the bed is lowered and the grate brought from two to four feet below the level of the fire-bridge, and the ashpit is provided with an iron door, by which it may be entirely closed when required. When the furnace is in full heat, I place the bars or lumps of raw or crude steel on the bed of the furnace, but at distances apart, so that they may nowhere touch each other; and during the whole of the refining process, the fire-place is kept fully charged with coals or other fuel. Then, in order to exclude as much as may be the access of oxygen, I carefully lute any crevices there may be, in the working door or elsewhere, with wet clay, and so regulate the draught of the furnace by means of the ashpit-door and flue-damper—closing them more or less, or altogether, as may be requisite—that the heat shall never attain to the melting point of steel. A sufficient practical test of this is furnished by the colour of the flame, which is, with this view, carefully watched through an eyehole in the working door. As long as it keeps of a dull or hardly red colour, the heat will not be in excess of what is required. I usually put from 900 lbs. to 1000 lbs. of raw or crude steel, in bars of 3 inches by 1¼ inches, into a furnace of the ordinary size, and continue the operation for about four hours. By this method of operation, carburetted hydrogen and oxide of carbon are developed in the furnace in abundance, while the oxygen of the atmospheric air is entirely prevented from acting on the steel; and the product is steel of a very fine uniform grain.

And having now described the nature of the said invention, and in what manner the same is to be performed, I declare that I do not restrict myself to the use of any particular form of furnace, nor to the subjection of the crude or raw steel to the refining process in any particular quantities, or of any particular sizes; but that what I claim is the refining of raw or crude steel (particularly puddled steel), by placing it in a furnace or other heating chamber, out of the reach of any injurious action upon it by the atmospheric air, and there subjecting it for a time to a temperature not exceeding the melting point of the steel.

Henry Walker Wood, of Briton-ferry, Neath, gentleman. *For improvements in the manufacture of fuel.* Patent dated December 7, 1850.

The present improvements have relation to that description of fuel which is composed of comminuted coal or coke mixed with pitchy, fatty, or resinous matters, and consist in heating such comminuted coal previous to its admixture with the pitchy or other matters, and in employing the coke whilst in a hot state, and immediately after its withdrawal from the ovens, in making such fuel.

Mr. Wood does not confine himself to any particular description of pug-mill, or apparatus for reducing the coal or coke, nor for heating the coal, or making the coke, nor to any particular fatty, pitchy, or resinous matters; but claims—

1. The making of fuel with coal or coke, in combination with some pitchy, fatty, or resinous substance or substances necessary for making a good and serviceable fuel, by applying heat to such coal or coke previous to their admixture with the pitchy or other substance.

2. The application of this mixture, or any other mixture of a similar nature, to preventing the decomposition of coal, by coating such coal with a covering of this mixture, or any other mixture better suited for the purpose.

James Ward Hoby, of Glasgow, engineer. *For improvements in the construction of the permanent way of railways.* Patent dated December 7, 1850.

Claims.—1. A mode of connecting the troughs of transverse iron trough-sleepers,

or bearers for holding and securing rails, so that one side or shoulder of each trough shall fit to and support one side of the rail placed within it, and so also that a key or keys may be introduced within the trough on the opposite side of the rail, for the purpose of supporting that side thereof.

2. A mode of connecting transverse iron bearers so that a shoulder or side of each such bearer shall fit to and support one side of each of the rails placed upon it, the other side of each rail being supported by chocks, with or without the aid of keys, or by a rib and keys combined.

3. A mode or modes of combining a transverse bar with bearers, without the aid of bolts, rivets, or keys.

4. A mode of constructing railway keys of two wedges, or two wedge-like or tapering pieces, in such manner that the wedges or pieces may be driven or act in different directions.

5. A mode of applying a piece of wood, in combination with the aforesaid double or folding keys, when such keys are made of iron.

David Lloyd Williams, of Thornhill, Llandilo, gentleman. *For certain improvements in furnaces.* Patent dated December 7, 1850.

Claims.—1. The constructing of furnaces with hollow fire-bars, through which the air employed for supporting the combustion of the fuel is made to pass.

2. The heating of the feed-water for boilers, or for other purposes, by causing the same to flow through the fire-bars of the furnace, and without being there subjected to the pressure of the steam in the boiler; and also a modification of the same arrangement, in which some of the fire-bars are employed for heating the air, and the others for heating water.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of 166, Fleet-street, patent-agents. *For improvements in agricultural machines.* (A communication.) Patent dated Dec. 7, 1850.

Claim.—The construction of reaping or grain-cutting and gathering machines according to the improvements described; that is to say, the constructing and placing of holding fingers, cutting blades, and gathering reels, respectively as described; and the embodiment of these parts as so constructed and placed, all or any of them, in machines for reaping purposes, whether such machines are constructed in other respects as described, or however else the same may in other respects be constructed.

James Thomson Wilson, of Stratford-le-Bow, Middlesex, chemist. *For improvements in the manufacture of alum and in obtaining ammonia.* Patent dated December 7, 1850.

1. Mr. Wilson's process of manufacturing alum consists in subjecting aluminous shales to the direct action of a sufficient quantity of sulphuric acid to saturate at a single operation all the alumina contained in them, and convert it to the state of sulphate, the alum being obtained by subsequent crystallization in the usual way. The shale should be selected of a kind as free as possible from coal, or iron, lime, and other soluble impurities, and after having been exposed to the air for two or three months, to reduce it to small fragments, and then burned in a lime or other similar kiln, is to be placed in an open boiler, about 15 feet long, 5 feet wide, and 4 feet deep, lined with lead, and having a false bottom at a height of about 15 to 18 inches above the bottom, composed of lead of about 24 lbs. to the square foot, perforated with numerous holes of half an inch diameter, and supported on an iron framework, and provided with suitable conveniences for allowing the bottom of the boiler underneath to be examined and cleaned out. Into this boiler, which is to be placed over a furnace in such a position that the flame does not rise to within a couple of inches of the false bottom, the shale is then deposited, the larger pieces being screened out, and laid immediately on the false bottom, and sulphuric acid of a specific gravity of 1·845, added in the proportion of 10 cwts. to every 12 cwts. of shale, with sufficient water to reduce the specific gravity to 1·35 or 1·4, and nearly fill the boiler. Heat is applied, and a gentle ebullition kept up for eight-and-forty hours, when the whole of the available alumina will have been dissolved, and the solution will be fit to be treated for crystallization by using sulphate of potash or ammonia. The patentee has, however, observed that, when alum is at once crystallized from solutions obtained as above described, a certain quantity of the acid in such solution remains in excess, and renders the purification of the alum a matter of difficulty. Now, to obviate this objection, he introduces into the solution either ammoniacal liquors of gas works, or condenses therein vapours containing ammonia which combines with the excess of acid, and renders the solution fit for immediate crystallization.

Claims.—1. The formation of sulphate of alumina by employing a sufficient quantity of sulphuric-acid at a high temperature, and thereby dissolving the whole of the available alumina of the shale operated on at a single operation.

2. The use of the essential construction of boiler and arrangement of materials

therein as stated, so as to allow of the application of sufficient heat to cause a thorough circulation of the liquors, and a perfect drainage of the whole of the shale, and thereby obtain the sulphate of alumina without waste of the materials employed.

3. The conversion or sulphate of alumina into alum by adding ammonia thereto, in such a state that it shall combine with the excess of acid contained therein, when obtained from shale by directly dissolving the alumina thereof in dilute sulphuric acid.

2. Mr. Wilson proposes to obtain ammonia by causing the gaseous products from coke ovens and furnaces to ascend through a shaft filled with coke or pebbles, down amongst which a stream of sulphuric acid and water is kept continually trickling. The acid and water is received into a vessel below, and returned, to be again used until exhausted. In order to prevent the deposition of soot from clogging the interstices of the pebbles, a stream of water must be occasionally forced through the shaft.

Claim.—The obtaining of ammonia from the gaseous products of coke ovens and furnaces, or places other than close vessels, used for the combustion or partial combustion and distillation of coal, by passing such gaseous matters through, or in contact with acid, water, or other substance capable of collecting the same.

George Henry Voyez, of Acton-street, artist. *For improvements in the manufacture of paper hangings.* Patent dated December 7, 1850.

In paper-hangings of the ordinary description, the pattern or design, such as a flower or group of flowers, is generally repeated lengthwise of the paper, and such paper, when hung to a wall, has the repeat in a vertical direction, and produces by this repetition an effect which is not pleasing in all cases, owing to the lack of diversity. Mr. Voyez now proposes to print paper-hangings with the design or pattern in a direction transversal to the length of the fabric, and to hang such papers horizontally; according to which arrangement paper-hangings with the same general ground, but with different patterns, may be employed in the same room, and their arrangement varied so as to produce effects diversified according to the arrangement in each case adopted.

Claim.—The manufacture of paper-hangings printed in such manner that they require to be hung horizontally.

John Everest, of Tonbridge, and George Osborne, of the same place. *For certain improvements in commodes, and in fixed and portable water-closets.* Patent dated December 7, 1850.

The patentees describe and claim—

1. Commodes with lids closed by strips of elastic material, and having a band passed over the handle of the lid, and connecting the opposite sides of the elastic material, for the purpose of equalizing the atmospheric pressure on each side of said lid at the time of raising it.

2. Fixed water-closets, in which the moving of the seat-cover brings the parts into action, and effects the flushing and emptying of the pan; and also an arrangement whereby the pan is kept constantly supplied with water.

3. Portable water-closets constructed on the same principle, but having the soil or discharge-pipe omitted.

William Edward Newton, of Chancery-lane, civil engineer. *For improvements in engines to be worked by steam or other power.* (A communication.) Patent dated December 7, 1850.

Claims.—1. Making the valve openings of governor valves to widen from the closed towards the fully open end, and also in such manner that when the governor acts on the valve under low speed it shall cause the opening or closing of that part of the steam passage where the widening or narrowing of the passage is more rapid than at the parts on which the valve acts at a high speed.

2. A peculiar form of valve opening, whatever may be the number of openings into which the space or valve seat is divided, and whether the said openings are made in plain or curved surfaces.

3. A spring set-screw re-acting against the pressure of steam on the valve cover, not only for relieving the valve from friction, but also for causing it to recede slightly from its seat when the valve approaches its open position, whereby an increased flow of steam is permitted, and the rate of flow augmented, the more the valve opens or the tension of steam diminishes.

4. The combination with a valve lever, adjustable to the stem of the valve, of an indicator, not adjustable, for the purpose of setting the valve in any required position without opening the valve-box.

John Mortimer, of Hanover-square, esquire. *For improvements in the magnetic needle and mariners' compasses.* Patent dated December 7, 1850.

The first of these improvements consists in constructing the needles of mariners' compasses with the axes on which they revolve nearer to one end than to the other, the weight of the long end of the needle and card being balanced by applying to the shorter end a piece of brass or non-magnetic metal. By this arrangement the needle comes to rest more readily, and is found to act better.

A second improvement consists in placing the pivot or axis of the needle in a grooved slide extending across the card (instead of making it coincident to the axis of the latter) so as to render it capable of being moved to a point over the card (or hemisphere) corresponding to the latitude of the place of observation; and if such an instrument be fitted to a sight which may place the axis or pivot of the needle, and the centre or pole of the card, in a direct line with the meridian, then by adjusting the index-hand to the needle, its variation at that point may be shown. For instance, supposing the latitude to be 40° north, the grooved slide in a direct line with the terrestrial pole, and the axis of the needle set at 40°, the variation of the needle at that point will be shown to be 16½°.

A third improvement consists in suspending a dipping needle by a universal joint or gimbal.

Claims.—1. The means of suspending the needles of mariners' compasses.

2. The construction of mariners' compasses above explained.

3. The mode described of suspending dipping compasses.

ALEXANDER MEIN, of Glasgow, accountant. *For certain improvements in treating the fleeces of sheep when on the animals.* (A communication from the late James Smith, of Deanston, Perth.) Patent dated December 7, 1850.

This invention consists in dipping the sheep into a succession of chemical solutions, so as to obtain an insoluble or sparingly soluble and water-repellent coating to the fibres of wool, thus increasing the warmth and promoting the health of the animal, and at the same time rendering the wool better suited for manufacturing purposes.

The bath in which the sheep are first dipped is composed by dissolving 20 lbs. of alum in 4 gallons of boiling water, and diluting to 40 gallons; the second bath consists of 31 lbs. of soft or black soap dissolved in a like quantity of water; and these baths will be sufficient for one hundred sheep. The dipping (for which three persons will be required—two to hold the sheep and the third to keep its head out of the solution) is recommended to be performed in a vessel of about 4 feet long, 2½ feet deep, and 2 feet wide, and capable of holding about 20 gallons; the sheep being allowed to dry between each successive dip. Arsenic or sulphur, to prevent the attacks of flies, &c., may be added to the above solutions if thought necessary.

Claim.—The application of chemical solutions suitably prepared to obtain, when used in succession, an insoluble or sparingly soluble and water-repellent coating to the fibres of wool when on the animal.

FRANCIS PAPPS, of Camberwell, chemist. *For improvements in metallic and other bedsteads, mattresses, and certain rods, and in the coating or covering of bedsteads, and other articles wholly or in part composed of metal.* Patent dated December 7, 1850.

Claims.—1. The arrangement and construction of bedsteads as described. [That first described is a sofa-bedstead of iron or wood, part of the frame of which is made to slide within the other part, so as to be capable of being extended at pleasure. When in use as a sofa, the ends of the mattress are raised, and act as cushions. A second bedstead is intended for the use of invalids, and has a frame covered with sacking to be laid on the mattress, so jointed as to admit of its being raised entirely or at either end, by an arrangement of levers (lazy tongs) and screws. Another improvement consists in making the laths of bedsteads of crossed slips of iron, pinned together at the centre and sides, so as to be readily folded up in a small compass; and also in making the head and end boards in a similar manner, and the frames with joints for the same purpose. A fourth improvement is the making of bed-sacking from sheets of gutta percha, in which the ordinary iron laths are imbedded, or which are simply provided with short pieces of metal having eyelet holes for attaching them to the frame.]

2. The construction of mattresses—1. By enclosing helical springs between two sets of laths, with or without an additional mattress of wool or hair, the said mattresses being so formed as to admit of their being folded up for convenience of transport; 2. By employing rock sponge coated with waterproof material; and 3. By enclosing the said mattresses in water and air-proof casing, to prevent the absorption of moisture or wet of any description.

3. An improvement in closing bed-curtains by means of a cord passed over fixed pulleys, and in covering curtain rods.

4. Certain improved methods of coating or covering iron bedsteads, or other articles composed of metal—1. With metals, by the agency of electricity; 2. With enamel; 3. With a metal less oxidable than that of which the article is composed, and a coating of enamel; 4. With glass, porcelain, or biscuit-ware, caused to adhere by employing for the purpose a material fusible at a less degree of heat; and 5. With gutta percha, or with compounds of gutta percha, and shellac, pitch, asphaltum, flock, or cork-raspings.

Specification Due, but not Enrolled.

SAMUEL RAYNER, of Berners'-street, Oxford-street, artist. *For improvements in paving.* Patent dated December 7, 1850.

WEEKLY LIST OF NEW ENGLISH PATENTS.

James Banister, of Birmingham, brass-founder, for improvements in the manufacture of metallic tubes for steam boilers and other uses. June 7; six months.

Robert Alexander Kennedy, of Manchester, cotton-spinner, for improvements in machinery applicable to engines for carding cotton and other fibrous substances. June 10; six months.

William Henry Fox Talbot, of Laycock Abbey, Chippenham, Wilts, for improvements in photography. June 12; six months.

John Emanuel Lightfoot, of Broad Oak, Accrington, Lancaster, calico-printer, and James Higgin, of Cobourg-terrace, Manchester, chemist, for improvements in treating and preparing certain colouring matters to be used in dyeing and printing. June 12; six months.

Frederick Crace Calvert, of Manchester, chemist, for a new application of certain fluids for manufacturing extracts applicable to the processes of dyeing, printing, and tanning, and in the apparatus connected therewith. June 12; six months.

John Chatterton, of Birmingham, agent, for certain improvements in protecting insulated electro-telegraphic wires, and in the methods and machinery used for the purpose. June 12; six months.

William Birkett, of Bradford, York, agent, for improvements in obtaining soap from wash waters. June 12; six months.

Felix Charles Victor Leon Levacher D'Urcle, of Paris, France, farmer, for improvements for increasing the produce of autumn wheat. June 12; six months.

Edward Lyon Berthon, of Fareham, Hants, clerk, master of arts, for improvements in boats, and in instruments for sounding and indicating the rise and fall and rate of currents. June 12; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
June 5	2835	J. Tennant	Shields, Monkton, Ayrshire	Self-cleansing diamond toothed wheel grubber.
11	2836	Groucock, Copestake, Moore, and Co.	Bow-churchyard	Stays for morning dresses.
,,	2837	S. Cocker and Son	Sheffield	Centripetal fish-hook.
,,	2838	J. Blackey	Halifax	Railway-ticket preserver.
,,	2839	H. Hicks	Davies-street, Berkley-square	Hick's Otium saddle.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

June 5	237	W. E. Wilson	Birmingham	Grease cock.
11	238	J. Terry and T. Powell	Birmingham	Rotary action safety-lock.
,,	239	S. Plimsoll	Sheffield	Exterior corner file.
,,	240	S. Plimsoll	Sheffield	Interior corner file.
,,	241	S. Plimsoll	Sheffield	Convex file.
,,	242	S. Plimsoll	Sheffield	Concave file.
,,	243	S. Plimsoll	Sheffield	Moulding file.
,,	244	Bloomer and Phillips	Sheffield	Spring and lever brace-pad.
,,	245	J. Cooper	Towerhead, Somerset	Compound geometric and spiral chuck.

CONTENTS OF THIS NUMBER.

Description of Captain Carpenter's Patent Duplex Propeller and Rudder—(*with engravings*) ... 461
Naval Architecture — White's and Griffiths' Treatises—(*review continued*) ... 465
Description of the Geotropescope, or Apparatus for Illustrating the Principle of Foucault's Experiment. By Dr. E. Henderson—(*with engravings*) ... 471
On Mr. Nasmyth's "Absolute Safety Valve." By William Morgan, Esq. ... 472
On Mr. Frost's "Stame," and Experiments of Mr. Whipple. By Mr. Frost ... 473
Effect of the Earth's Rotation on Projectiles. By Rev. Osborne Reynolds ... 474
Mathematical Periodicals.—No. XXVII. By Thos. Wilkinson, Esq., F.R.A.S. ... 474
Specifications of English Patents Enrolled during the Week:—
Bernard ... Boots and Shoes ... 475
Hinley ... Castors ... 475
Franklinsky ... Public Vehicles ... 475
Riepe ... Refining Steel ... 476
Wood ... Artificial Fuel ... 476
Hoby ... Railways ... 476
Williams ... Furnaces ... 477
Brooman ... Reaping Machines ... 477
Wilson ... Alum and Ammonia ... 477
Voyez ... Paper-hangings ... 478
Everest and Osborne ... Commodes ... 478
Newton ... Steam Engines ... 478
Mortimer ... Compasses ... 478
Mein ... Treating Fleeces ... 479
Papps ... Metallic Bedsteads 479
Specification Due, but not Enrolled:—
Rayner ... Paving ... 480
Weekly List of New English Patents ... 480
Weekly List of Designs for Articles of Utility Registered ... 480
Weekly List of Provisional Registrations ... 480

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THE PATENT AMERICAN CORN-REAPER.

Fig. 1.

Fig. 2.

THE PATENT AMERICAN CORN-REAPER.

[Patented, on behalf of Inventor, in name of R. A. Brooman, December 7, 1850. Specification enrolled June 7, 1851.]

Specification.

This invention has special relation to that class of machines which are worked by horses in cutting or reaping wheat, corn, or other grain, and has for its object the better holding of the stalks of the grain in a favourable position while being cut, and the more conveniently arranging, collecting, and disposing of the same when cut.

Fig. 1 is a side elevation, and fig. 2 a plan of a reaping machine constructed according to the said invention. AA is a frame of wood of a triangular form, to the front of which there are fixed the pole B and whipple-trees CC. The back rail D of the frame is prolonged on one side of the machine, so as to project about six feet beyond the frame, and the projecting portion forms the basis of a platform E; F and G are two wheels upon which the machine is mounted. The wheel F (from its position) bears the greater portion of the weight of the machine, and is employed for communicating motion to the moving parts, as afterwards described. H, H, H, are a set of fingers, somewhat of a spear-head shape, which are affixed to the front edge of the platform, and placed at regular intervals apart from each other. Immediately underneath these fingers is placed the cutting blade I, which is formed of a thin plate of steel, toothed upon its front edge, and fitted into a groove, or into bearings attached to the front of the platform. Fig. 3 is a cross section of the rail D and the cutting blade I; showing the method of attaching the fingers HH to the front of the platform, and their relation to the cutting blade. This blade has perfect freedom to slide from one side of the machine to the other, but the amount of range given to it is limited by the crank K, to which it is attached by means of a connecting rod L. M^1 is a bevel wheel which is keyed to the shaft of the wheel F, so that both may revolve together and give motion to a bevel pinion M^2 and wheel M^3, which are fixed to an intermediate shaft N. The wheel M^3 gears into a pinion O placed on the crank shaft, and consequently gives motion to the crank K, the connecting rod L, and the cutting blade I. The number of teeth of the intermediate gearing which has just been described are so proportioned and adjusted that the cutting blade may reciprocate and do its work very rapidly. PP is a large reel or gatherer, which is of very light construction; and carries at its extremities four blades R, R, R, R, made of thin deal. At the near side of the machine this reel is supported by an upright S, and at the off side by a brace T, which is raised upon the back of the platform. When the machine is going forward, the reel is made to revolve in the direction indicated by the arrow by means of a band or belt U, which takes on to the rim of the bevel wheel M^1 and the rigger V; the latter of which is keyed to the reel shaft. The distance of the reel from the platform is capable of being adjusted by means of the sliding bearing *a* (upon the near side of the machine), which is acted upon by the screwed rod *b*. At the further side the brace T is fixed to the spur T^2 by means of a moveable bolt; so that the brace may be raised or lowered at pleasure by passing the moveable bolt into any one of the holes (b^1 b^1) further up or down in the spur. W is a seat for the driver; and X a seat for the person gathering the reaped grain from the platform.

When the machine just described is applied to the cutting of wheat or other grain, it is brought to the edge of the field (with either two or four horses yoked to it), and with the platform placed in front, and the horses alongside of the crop to be cut down. As the horses advance, the wheel gearing is put in motion, which causes the reel slowly to revolve, and so prevent the straws or stalks from being pressed forward when they come in contact with the cutting blade, which has at the same time a rapid reciprocating motion imparted to it by the action of the crank K and connecting rod L; the straws or stalks are thus speedily cut through, and fall backwards on the platform.

The fingers H H H greatly facilitate this part of the operation, as they hold the straws or stalks from yielding along with the lateral action of the cutting blade; and it is for the more effectually accomplishing this object that they are formed of a shape like to a spear-head, which causes the straws or stalks to slide into the spaces between them when in that position, and as the inclined edges at the roots of the fingers (that is immediately over the cutting blade) form an acute angle with the edge of the knife, the cutting through of the straws or stalks is sure to be effected by the reciprocating movement of the knife-blade. Two separate views of parts of the fingers and cutting blade are given in figs. 4 and 5; the blade in fig. 4 is straight in the cutting edge, while that in fig. 5 is zig-zag or of an indented form.

Fig. 3.

Fig. 6.

Fig. 4.

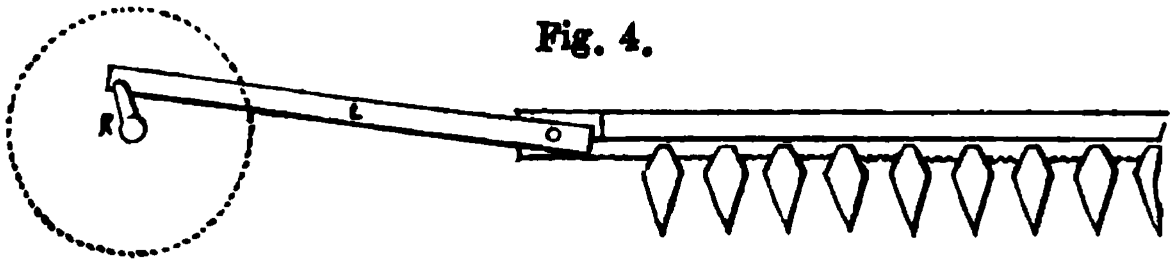
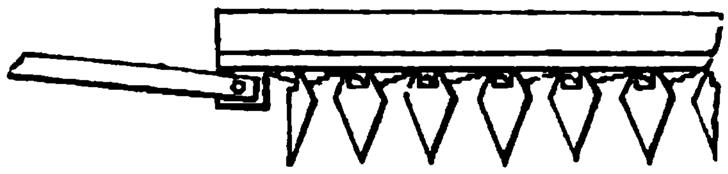


Fig. 5.



In every case, however, it has been found to be of great advantage to have the cutting edge toothed, somewhat similar to a sickle, and to have the teeth divided into sections corresponding to the number of fingers, each section having one half of the teeth inclined in one direction, and the other half having the teeth inclined in the opposite direction. As the straws or stalks of the crop which is in the course of being reaped are cut through by the action of the cutting blade, as just described, the continued rotation of the reel causes them to fall over upon the surface of the platform E, from which, as they accumulate, they are drawn off with a common hand-rake (by the attendant who sits upon the seat X). The quantities so drawn off are each about the size of a common sheaf, and delivered on to the ground immediately behind the frame A A of the machine; thus leaving a clear space for the return of the machine in case the binding of the sheaves may not have kept pace with the progress of the reaping or cutting machine. Y^1 is a wheel-board, which turns the standing grain in before the cutting blade upon the near side of the machine, and Y^2 is a "separator" which performs a similar part upon the off-side of the machine. Y^3 is a brace which gives stiffness to the support for the reel, and serves to keep the reaped grain from being dragged over the back of the platform. L is a canvass back to the platform.

When the machine is being transported from one place to another, the intermediate gearing for communicating motion from the shaft of the wheel F to the cutting-blade and reel, is disconnected by the lower bearing of the intermediate shaft being moved aside; for which purpose the bearing *c* is fixed in one end of a lever *d*, shown separately in fig. 6. The lever is attached at the centre to the frame by a pin *e*, upon which it is free to move as a fulcrum; the other end of the lever *d* is fixed to the frame by a bolt passed through the hole *f*, so that by undoing that bolt the wheels may be readily thrown into or out of gear.

NAVAL ARCHITECTURE.—WHITE'S AND GRIFFITHS' TREATISES.

(Review, concluded from p. 470.)

Having concluded our remarks on those portions of the theory of Naval Architecture which are settled on a solid basis, we now enter on a region, which, notwithstanding all the pains that have been bestowed in exploring it, may still be considered to a great extent a "terra incognita," affording indeed to such speculators as Mr. Griffiths, a wide field in which they love to disport themselves, very much to their own satisfaction, though very little to the benefit of science or any good purpose. The laws which regulate the motion of a fluid when disturbed by a solid propelled in it, and the resistance which it offers to the motion of the solid, have hitherto eluded the grasp of the most profound mathematicians; and, for that very reason, we suppose, every would-be-philosopher whose evil genius directs him to this branch of science inundates the world with his sage speculations on these abstruse points, which he has the modesty to conceive will produce a revolution in the notions of the scientific world, and finally set the whole question of resistances at rest.

These speculations,—harmless enough in themselves, on account of their very unin-

telligibility, are however injurious to the cause of science,—inasmuch as the ignorant and unwary into whose hands they fall, are apt to mistake them for true philosophy, and hence imbibe the notion, so prevalent among practical men, that science is useless. Indeed, more damage has been done to the cause of real science by such pretenders as our American author, who boast that they have discovered the true mode of reconciling theory and practice, than by any other means: and for this reason, we think it our especial duty to expose the emptiness and folly of such bombastic pretensions with an unsparing hand. At the same time, it is an undoubted fact, that those who make it their boast that they are *practical ship-builders*, and despise science, in reality do her unconscious homage by the adoption of principles which she alone has pointed out to be true, and which experience could never have established, though it might sometimes have stumbled on them. Those, however, who from a spirit of vain glory endeavour to wrap science in a garb of mystery, or claim for her a province which does not belong to her, do her no service, while they expose their own weakness.

It were foolish to pretend that the laws of resistances of fluids were sufficiently established to present any tangible results to practical men. There is yet a wide field for discovery in this direction; and unfortunately *that which is least known* is the most interesting to the naval architect, as affecting most directly the question of the *best form of ships for speed*, and the proper position and height of masts. Before we attempt to lay before our readers Mr. Griffiths' researches, it will be well to put them in possession of the present state of our actual knowledge on this question. By *resistance*, we understand that force which is opposed to the motion of a vessel through the water by its *inertia*, the coherence of its particles, and the friction of the fluid against the sides of the vessel. Amongst these retarding causes, however, by far the most powerful is inertia, or, rather, that whose measure is the direct *pressure* exerted by the fluid.

If the vessel is at rest, the horizontal resultant of all the pressures upon its surface must be zero. As soon as it moves, this is no longer the case; and the *normal pressure* of the fluid against every element of the surface undergoes a change, being increased on the portion situated before the greatest transverse section, and diminished on that situated abaft. It is evidently the *difference* between these pressures and the pressures that would be exerted on the body *at rest*, which tend to retard it, and must be brought into comparison with the propelling forces. The most simple case of resistance, is that of a plane moving in a fluid in the direction of a normal, in which case the fluid impinges directly upon it. It is assumed that the resistance to the motion of the plane is the same, whether it moves with a given velocity through the fluid at rest, or the fluid impinge with the same velocity upon the plane at rest. Suppose, then, a fluid moving under the action of certain forces with a velocity v, then it is easily proved, that if S be the resolved part of the resultant force on any particle of the fluid in the direction of its motion, an element of the path described by this particle, ρ the density of the fluid, and p the pressure

$$\frac{1}{2}v^2+\frac{1}{\rho}p=\int Sds.$$

Suppose, now, an immoveable plane is introduced into the fluid, the velocity of the particles which come in contact with it (in the direction perpendicular to the plane) is destroyed, and hence their pressure is increased. Let p' be this pressure; then its value may be obtained from the above equations by putting in it $v=o$, which gives

$$\frac{1}{\rho}p'=\int Sds,$$

$$\therefore\ \frac{1}{\rho}(p'-p)=\tfrac{1}{2}v^2,\ \text{or}\ p'-p=\tfrac{1}{2}\rho v^2.$$

But $p'-p$ is the measure of the *resistance* of a square inch of the plane on the fluid, or (what is the same thing in this theory) of the resistance of the fluid (at rest) on a

square inch of the plane moving directly through it with a velocity v. Therefore, if R be the resistance on a unit (say a square inch of the surface), $R = \frac{1}{2}\rho v^2$. It is observable here, that the resistance is totally independent of the *depth* of the element below the free surface of the water, and depends only on the density of the fluid and the velocity of the plane. On this theory, therefore, the resistance on *each* unit of the plane is equal to the weight of a column of fluid whose base is the unit of surface, and whose height is the distance through which a body must fall by gravity to acquire the velocity. If the stream impinge *obliquely* on the plane, its velocity must be resolved into two,—one perpendicular to the plane, and the other along it; by virtue of the latter of these, the particles of the fluid *slide* along the surface of the plane; and the former is that on which the resistance depends: if, therefore, a be the angle which the direction of the stream makes with the plane, v sin., a must be substituted for v in the expression before obtained, and

$$R = \tfrac{1}{2}\rho v^2 \sin.^2 a = g\rho h \sin.^2 a$$

is the expression for the resistance on a unit of surface so altered.

It is evident, *à priori*, that this theory is faulty, as no account is taken in it of the consequences of the particles seeking to escape laterally, which must bring them into collision with other contiguous particles, and so alter their velocity and direction of impact on the plane. No theory, however, has been constructed to measure this effect; and it must consequently be remanded to experiment, to determine the extent to which the theory (which does not pretend to take account of all the circumstances) is to be trusted. Accordingly several series of experiments have been instituted at various times, having this especial object in view; among these, the most important were those conducted by D'Alembert, Bossut, and Condorcet, under the patronage of the French Government in 1776, and those conducted under the superintendence of Colonel Beaufoy for the Society for the Improvement of Naval Architecture in the Greenland Docks at the commencement of the present century. On the whole, considering the eminent position of the experimenters in the scientific world, and the vast care taken to insure accuracy, we think that the experiments of D'Alembert and his coadjutors may be considered, as far as they go, conclusive. They addressed themselves as far as the resistance of a fluid infinite in extent, such as the ocean, is concerned, to the consideration of these principal points.—1st. Whether in direct impact the resistance varies as the area of the plane? 2nd. Whether it varies at all by altering the *depth?* 3rd. According to what power of the velocity it varies? 4th. In oblique impact this law is how modified. 5th. What is the actual measure of direct resistance on a plane? and, 6th. What effect the coherence of the particles and the friction of the fluid produce. We cannot do better than present to our readers the results of their labours in their own words, as we believe we shall thus best put them in possession of *what is known* on the question of resistances, *and what is not*. Their conclusions are as follows:—

"*First*. That the resistances experienced by the same body, *whatever may be its figure*, moved with different velocities through a fluid infinite in extent, *are very nearly in proportion to the square* of the velocities. It has been shown that the resistances increase in a rather greater ratio than that of the squares of the velocities. Experiment, therefore, agrees on this point very nearly with theory.

"*Secondly*. That the perpendicular and direct resistances of several plane surfaces, moved with the same velocity, are very nearly proportional to the areas of the surfaces. This proportion may be brought very near to equality, by considering the different effect produced by the different vessels in the rising and depression of the fluid. Consequently, experiment and theory may be said to agree also on this point.

"*Thirdly*. That the resistances which arise from motion in oblique directions do not diminish, everything else remaining the

same, *in proportion to the squares of the sines of the angles of incidence*; therefore, on this third head, the common theory of the resistance of fluids should be abandoned altogether when the angles of incidence are small, as then the results deduced from it would be very erroneous. It is evident also that it cannot be employed to find the solid of least resistance, nor generally to determine any curve; for in such problems the law of curvature is an unknown element. But for cases in which the angles of incidence are large, as from 50° to 90°, we may make use of the theory—always remembering that the resistances which result, will be rather less than those given by experiment, and that the error will be greater in proportion as the angles of incidence are smaller.

"*Fourthly.* That the perpendicular and direct resistance of a fluid of infinite extent, is nearly equal to the weight of a column of fluid, of which the base is equal to that which is due to the velocity with which the impulse is given.

"*Fifthly.* That the *tenacity* of the water may be considered as *vanishing*, when compared with the resistance arising from the *inertia*. The same observation applies to the *friction*, which cannot be of any importance, excepting in a case in which a vessel has a most excessive length in comparison to her breadth."

From these conclusions it appears, that if the resistance against the motion of *any vessel* be known for any one velocity, it can be deduced for any other velocity: in fact, the resistance may be always represented by Av^2, where v is the velocity and A is a constant, invariable for the same ship, but different in different ships, which may be considered as a function of the area of the midship section. It may not be taken *equal* to the midship section (as it is sometimes the custom of practical men to do), but is generally some fractional part of it, depending on the relative fineness of the bows and other causes. Again; as in screw-propellers of the ordinary form and pitch, the angle of incidence of the water generally exceeds 50°, no appreciable error will be introduced by applying the common theory to it. We may here observe that these deductions, and consequently the experimental laws on which they are founded, have received strong confirmation from some important practical results deduced by Professor Main from the theory of the screw-propeller.—(*See* "Marine Steam Engine," by Professor Main and Thos. Brown, Esq., p. 270.) Starting with assumptions made in conformity with these laws, he arrives at the following conclusions:—

"(A) The slip of the screw will be diminished—

"1. By the increase of the area.

"2. By the decrease of the angle.

"3. By the increase of the diameter.

"(B) 1. The horse-power of an engine driving the screw (in still water) varies as the cube of the speed, as in paddle-engines, *so long as the same screw is retained.*

"2. And *whatever* screw be used in the same vessel, the horse-power varies as the square of the speed of the ship multiplied by the speed of the screw."

Experience has amply verified these laws, and thus indirectly the laws on which they themselves depend. Our readers will find appended to a letter of Professor Main, page 247 of the present volume of the *Mechanics' Magazine*, a Table, showing the results of some careful experiments made on the *Dwarf.*

Experiments made by Sir Isaac Newton, and since verified by Chapman and others, established the fact that, in vessels of the ordinary shape, the resistance is the same whichever end be first opposed to the water at low velocities; but at considerable velocities, the resistance against the obtuse end is less than against the sharper end. This experimental fact led to the common practice of placing the midship section, or section containing the *greatest breadth*, before the middle of the length. It is now proposed by Mr. Scott Russell and his followers to place it abaft this point. We cannot say that the experiments of Newton and Chapman were sufficiently conclusive to justify an absolute and immediate condemnation of

these new views; for we think the *forms of bows were hardly enough varied in those experiments;* and it is *possible* that a more extensive experience might show that, in vessels whose bows have the form known as "the wave form," the main breadth might with advantage be shifted further aft. At present we are scarcely in a situation to decide on this knotty point.*

We cannot dismss this subject without adverting to Romme's experiments, which were favourably reported on by a Committee of the French Academy of Sciences, which seemed to establish the fact that, within certain limits, the resistance on a vessel is not appreciably affected by the *form of the bows*, but varies directly as the area of the midship section, and inversely as the distance of that section from the stem. This law seems to us to have received confirmation from recent facts. Several vessels, both in Her Majesty's navy and belonging to private owners, have been lengthened with the happiest effect, to the improvement of their speed and other good qualities; thus establishing the fact that the proportions so long adhered to, and supposed to be established on the firmest basis, are not entitled to that amount of respect which was formerly paid them.

We have done our best to lay *briefly* before our readers the present state of the question of the resistances of fluids. The great *desideratum* now evidently is to ascertain the actual law for oblique incidence when the angle is below 50°. That which we desire to know, in order to give a vessel the form of least resistance or greatest speed, is therefore just what is wanting. We cannot help expressing our belief that the time has arrived when the Government of this great maritime country might with advantage set on foot a series of well-selected experiments, having for their object the elucidation of this and other moot points in naval architecture. They would require a considerable outlay, it is true; but the benefit which may fairly be expected to arise from them would make them, in the end, truly economical. To insure their success, a committee of scientific men should first draw up a carefully-digested plan, pointing out the experiments which might be advantageously made, and the best mode of conducting them: and the execution of the plan thus suggested should be committed to *several* men of science whose studies have been in this direction.

The Admiralty possess in the Astronomer Royal one of the highest European authorities on all matters connecting theory and practice, who would naturally be placed at the head of such a commission; and among those to whose services they have a claim it would not be difficult to point out several who would naturally be associated with him, and some *independent* eminent philosophers in carrying out this design, which, for real utility, would not suffer by comparison with many objects on which the Admiralty have not scrupled (and rightly, too,) to expend large sums of public money—such as the Arctic expeditions, &c.

It is needless to say that resistance, under the hands of our New York philosopher, assumes a very different complexion from that which we have endeavoured to give it, desirous as we are to expand what is settled and to reconstruct what is abandoned—proceeding on the *true principle of induction*, and reaping the fruits of the labours of our predecessors. Mr. Griffiths, on the contrary, cannot afford time to consult "the

* When we speak of the *possibility* of a removal further aft of the main breadth being found an improvement in certain cases, it must be carefully noted that this remark applies only to *speed* when going straight before the wind, or in a river. Many other qualities have to be considered in sea-going boats; and there is every reason to believe that it will be an impossibility to remove the main breadth far aft in such vessels, because we must thereby also remove the centre of gravity aft in like manner, the effect of which would be to increase the leverage of the mean resistance on the fore part of the vessel, and to diminish the leverage of the force which acts on the rudder; on both which accounts the *steering qualities* of such vessel would suffer very materially. But we shall have a better opportunity of discussing this point when we analyze the wave form, as we propose doing.

musty folios of the past," but, *more suo*, comes forth with a theory (if it deserves the name) spick and span new. We will endeavour to analyze it, as far as the obscurity of the language in which he has thought fit to clothe it will permit us. He first of all tells us, that "a variety of theories have been promulgated by men of science for *overcoming* (?) what the author has, in common with his fellow mechanics, called resistance," which we shall not mention. "Resistance," he tells us, "has, from time immemorial, furnished not only an extensive field for operative genius, and skill in every age, but *has also furnished the motive* power for overcoming the same, and may emphatically be termed the main-spring in mechanics. The great Syracusan philosopher required but an amount of resistance commensurate with the friction of his levers, added to the weight of the world, and he would have had a platform for his fulcrum." We do not think Mr. Griffiths a very happy exponent of the desire of Archimedes, who expressed a wish for a *fulcrum*, meaning himself at one end of his lever to move the world by help of his fulcrum or immoveable obstacle at the other. Of course the pressure on this fulcrum would have been the weight of the world and himself. Our author then takes occasion to dilate on the three laws of motion, in which we shall not disturb him. After this wholesome exercise, he tells us—"As the whole doctrine of resistance in fluids is based on the equilibrium of the same, we shall here give a general view of the leading principles of this branch of *equilibriated gravity* in fluids."

We certainly do meet with the most unexpected statements sometimes—and this is by no means one of the least extraordinary it has been our fate to encounter. We thought that resistance implied motion in its very idea, and had but little to do with *equilibrium*; in this it seems in common with our old-world philosophers or we are mistaken. Mr. G. then enters on a long account of attraction, in which we shall not follow him, but content ourselves with stating his conclusion in direct opposition to that of D'Alembert, &c., based on experiment. "It will, doubtless, be discovered by what has been shown (by-the-bye *nothing* has been *shown*) that cohesive attraction forms a *very material part of the resistance* met by floating bodies. He then, *en passant*, aims a *heavy* blow at Mr. Scott Russell's wave theory. The attracting power of gravity, and the pressure of the air are then considered as forming component parts of the resistance to be overcome in navigating oceans, lakes, and rivers. Here, too, he is at direct issue with our "ancient" friends, D'Alembert, Condorcet, and Bossut, who established the fact that gravity had nothing to do with the *resistance of fluids*, but only their density, and the velocity of the body impelled through them.

When he comes to calculation, however, he multiplies the area (in square feet) of the immersed portion of the greatest transverse section by 64⅔, the weight of one cubic foot of sea-water, and multiplies that product *by the velocity* in feet per minute. He does not condescend to tell us why he takes *the velocity* as a factor rather than any power of it, such as the square, as experiments suggest. His doctrine is probably so far "in advance of the age," that he does not give us his *reason* through fear of misapprehension. He gives a numerical example, the result of which is "13418 tons, 138 lbs. per minute in adverse pressure or resistance." He then adds, "*In order to have this resistance or pressure constant*, the quotient or last number must be divided by 60." We really cannot see why dividing by 60 makes a pressure constant. What cabalistic value is in the number 60? Why not divide or multiply by some other number? We really want enlightenment on this point. The author then proceeds to illustrate a statement he ushers in with a great flourish of trumpets, that "there is a definite amount of speed peculiar to every shape, and belonging to every shape, and beyond which, if forced, the vessel would not go without hazard." His remarks, how-

ever, go to show that the resistance may be so great that between it and the propelling power the vessel may be torn to pieces; this we do not dispute, but has not the strength of the vessel, the *scantling* of her *timbers*, and the mode in which they are put together, quite as much to do with this unhappy result as the *form* which, after all, operates only in increasing or diminishing the amount of resistance? We cannot follow our author in his *reasonings* on the cause of steam-vessels, with a very flat floor, becoming broken-backed and grounding when there is sufficient depth of water to float them at rest. As a specimen, take the following sentence, and whoever can discover its meaning, let him follow our author through the rest of his remarks, "Inasmuch as all and every molecule of the fluid is spherical, and revolves around its own centre, so every molecule is least disturbed by appropriating a line of direction to itself alone; the motion of the molecules thus directed prevents their crowding on each other, and upon this, the whole theory not only equilibriated gravity in fluids, but of resistance rests; whether from cohesive attraction, or from attrition, it all centres in this universal law." Here, then, our American author has discovered what may in naval architecture be called the "philosopher's stone." See how, with a few bold strokes, a master mind unravels the deepest mystery!

We will not follow our author in his development of the "lines of resistance," which he proposes to substitute for water-lines, and which, if they possess no other merit, have undoubted claim to this, "that they are unshackled from those venerated notions so prevalent in the commercial world."

"The laws of propulsion," we are told, "claim our attention, and seem to be almost inseparably connected with resistance, as there can be no propulsion without resistance. The term, however, has no application to a body moving on a rigid plane. In its most comprehensive sense, it may be defined as belonging only to such bodies as are sustained on a fluid, for the evident reason, that no body sustained on a rigid plane by the centre of gravity, *can be moved without the application of an excess of power over that concentrated at the same*." And further on, "Here, again, we see equilibriated weight in floating bodies, *standing out in drastic* (!) *contrast* with equilibrium of the same body when on a rigid plane. Resistance increases under the same circumstances in proportion as the density of the fluid increases, by which the floating body is sustained, and were it possible for the fluid on which a vessel floats to become of equal density with the earth, and at the same time occupy no *larger space* than when a fluid, the vessel, instead of being sustained by a portion, being immersed, would continue to rise until she would rest on the surface: under such circumstances, it would require a power more than equal to the weight of the vessel to move her, without the application of the measures to reduce the friction."

With this remarkable exposition of his views, we shall conclude our extracts from Mr. Griffiths' work, which indeed we should not have made so copious, but that it is so highly commended by the New York press. We will venture to assert, that it would be difficult to find an equal number of words in any book, whether professing to be scientific or not, that contains an equal amount of nonsense. In the first place, why should it require a power larger than the weight of a body resting on a plane to move it? To lift it up from the plane it would; but surely not to move it along the plane. We should then require only to exert a force greater than the friction, which is only a fractional part of the weight in all cases. Nor do we think that every the slightest force would suffice to move a vessel through the water, as our author asserts; let Mr. Griffiths try to move a man-of-war by his own strength; and he will tell us a different story. Again; is it necessary that the density of a fluid be *less* than that of the earth? For Mr. Griffiths evidently supposes that his fluid, by increasing its density, so as to become equal to

that of the earth becomes solid. Why should it not remain fluid, and in that case what is to prevent his ship still displacing a bulk of this fluid, whose weight would be equal to its weight? A more unhappy illustration we certainly never remember to have encountered.

We regret that we cannot congratulate the United States on "the Book of Naval Architecture" which the New York press has so ceremoniously ushered into the world. Probably, however, some work may appear on the other side of the Atlantic written by a man of real science (and such men are by no means wanting there); and then we promise our somewhat sensitive cousins, whose irritability we may perhaps have excited by discharging the duties which we have undertaken, that we will be among the very first to welcome its arrival, and heartily join in their songs of triumph. But although we dismiss Mr. Griffiths, we cannot take leave of the subject which he has been the means of pressing on our attention without one more observation.

Mr. Griffiths in the course of his work mentions, for the purpose of condemnation, some statements of Captain Fishbourne, whom he flatters with the appellation of being a scientific man, and from whose work he has evidently taken his exposition of Mr. Scott Russell's wave principle. We think it our duty to inform Mr. Griffiths and the American scientific world that Captain Fishbourne's Lectures on Naval Architecture, delivered at the United Service Institution, never have been received, and we venture to say never will be received, with the slightest degree of favour by the scientific naval architects of this country, of whom we can boast not a few. It is true we have pretenders here, as elsewhere; and, by some unaccountable fatality, this science, which ranks amongst the highest and most difficult of applied sciences, has ever been beset by a greater number of charlatans than any other. It seems among a certain class to be almost a recognized principle "that any one can build a ship." No previous training—no acquaintance with exact science—seems requisite; all the qualifications necessary apparently are boldness and assurance, a firm reliance on the inspirations with which the gallant speculator thinks himself favoured, and a full persuasion that every one else is wrong. Unfortunately, from time to time this mania seems to have infected the highest naval authorities; and a *carte blanche* to some daring son of Mars to build a steamer or a frigate has been the consequence: and thus our navy has been inundated with *Sidons*, and *Januses*, and *Vernons*, and *Albions*, and "*hoc genus omne;*" while the man, perhaps, who has made naval architecture the study of his life, and really has proposed a plan of some merit, exhibiting a decided improvement, has had the greatest difficulty in obtaining a favourable hearing, or been sent empty away. We trust, however, that the morning of a better day has dawned, and that due caution will henceforth be exercised as to the scientific qualities of those who will be commissioned to construct our ships.

For the especial benefit of that class of naval architects on whom Mr. Griffiths work is likely to produce the greatest effect, we shall, at no distant period, enter upon a discussion of the wave principle, which many of the readers of the *Mechanics' Magazine* may find not uninteresting; and, as Captain Fishbourne has put himself forward as its principal advocate, we shall have an opportunity of explaining to what amount and to what kind of credit his lectures are entitled.

MAYES'S REGISTERED FLOORING-RAM.

(William Millbanke Mayes, of Boston, C.E., Proprietor.)

Fig. 1 is a longitudinal section, fig. 2 a plan, and fig. 3 an end elevation (partly in section) of this tool. AA is a metal case, upon the sole of which rests the ram B, which is made of some hard wood. On the upper side of the ram there is fixed a rack C, into which the teeth of the pinion D gear. E is a wheel which is keyed to the same shaft with the pinion D, and gears into the pinion F, the axle of which passes

Fig. 1.

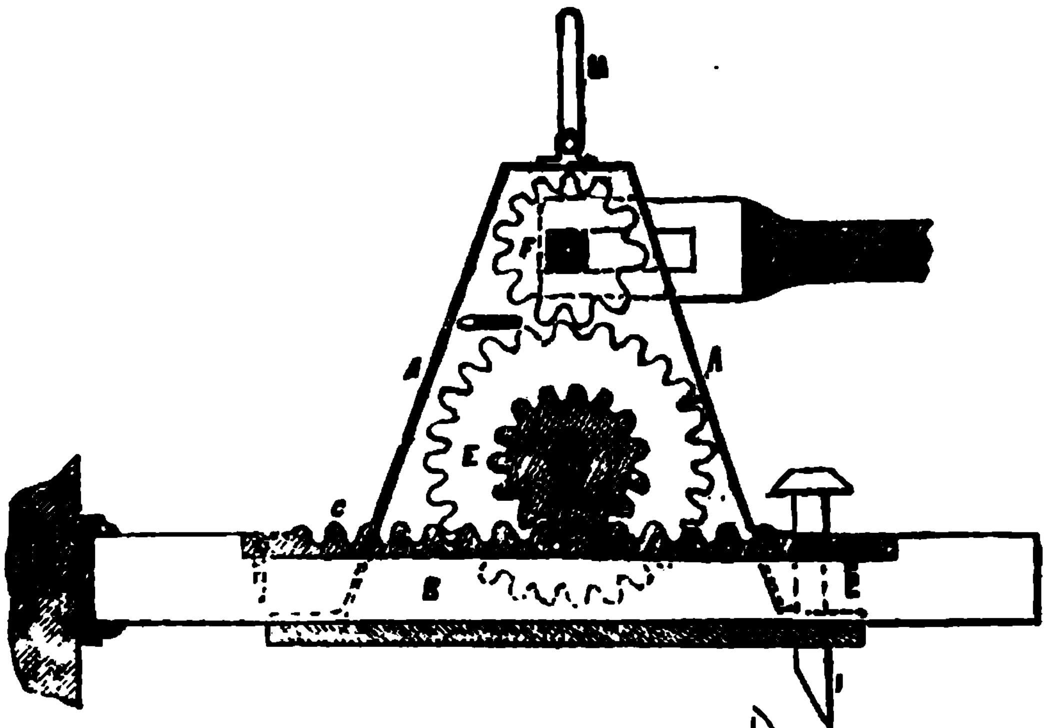


Fig. 3.

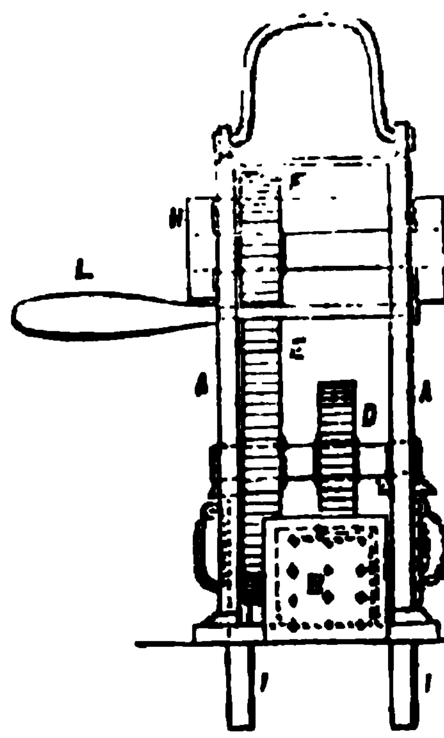
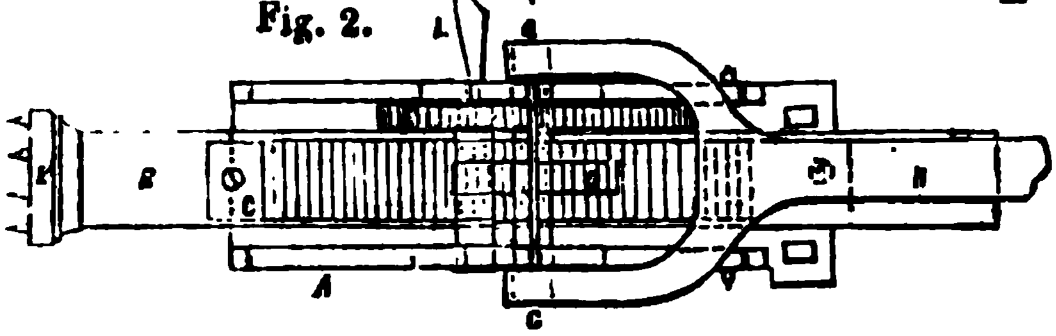


Fig. 2.



through both sides of the case, and terminates in square ends G G. H is a cleft handle, in each of the prongs of which there is a slot fitting to one of the squares GG. I is a spike or chisel, which is driven a short way into the joist, and K a metal termination to the ram B, by which it either presses against the flooring board or an intermediate piece of wood. L is a hand pin by which the pressure may be continued any length of time, as it acts as a stop to the wheels; and M is a handle for lifting the apparatus.

When the case is fixed to a joist by the spike and weight applied to the handle H, to cause the ram to protrude, it exerts a degree of power against the flooring deal to retain it in its place, while being fixed, much beyond that possessed by any instrument of the sort now in common use.

THE CONICAL-SHAPED BALL.

Sir,—I perceive it is stated in the public prints that the authorities at Woolwich have determined to give a trial on a large scale to the conical-shaped ball for muskets. There can be no doubt that the preliminary trials which have been made have, so far, turned out satisfactory.

It will be fresh in the recollection of (many of) your readers that I formerly addressed you on the subject of the laws of atmospheric resistance.* According to the theory then made public, the negative pressure, or pressure on the hind part of a plane moving through the atmosphere, can never exceed the pressure of the atmosphere itself, or, indeed, be quite equal to it, unless the velocity be infinite. On the other hand, the positive pressure, or pressure on the front of the plane, may become *indefinitely* great on the velocity being *indefinitely* increased.

Now the new projectile is formed almost flat behind, whilst it is of a conical shape in front. This is precisely the form it ought to possess in conformity to the theory; the resistance in front is evaded to a great extent by the conical form, whils. the flat shape behind it scarcely increases the resistance in an apprcciable degree, and

makes it even more proper for receiving the impulsive force than the spherical shape.

The success of the projectile adds, therefore, something to the confirmation of the truth of the theory; and it seems not impossible that it may have furnished the inventor with a hint of what was required on the subject.

I should be glad to learn whether the theory has ever been controverted. I have been on the look out, but have not seen or heard anything bearing on that point.

I have been continuing the investigation (of the laws of atmospheric resistance) at intervals, and the result of these further researches I trust to be able to communicate to the public at a future opportunity.

I am, Sir, yours, &c.,
JOHN POTTER, C.E.

Corporation-street, Manchester,
June 16, 1851.

MATHEMATICAL PERIODICALS.

No. XXVII. *The Enigmatical Entertainer and Mathematical Associate.*

(Concluded from p. 475.)

Questions.—The total number of mathematical questions proposed and answered in the *Associate* is 60; of which 10 belong to algebra and its applications; 9 to geometry; 17 to the different branches of mechanics; 11 to loci; 2 to trigonometry; 6 to hydrodynamics; and 4 to the differential and integral calculus. Most of the exercises appear to have been very carefully selected, and not a few involve difficulties of the highest order. Algebraical solutions are frequently added to the geometrical exercises, and thus afford a ready means of comparison between the relative merits of both methods of investigation. The differential notation is almost entirely adopted, but the method of co-ordinates does not appear to have been applied except on one occasion in No. IV.

Ques. 1, by Mr. Jerwood, determines "the number by which a people must increase annually, so that they may be doubled at the end of every century;" a subject more fully treated in Bridge's "Algebra," and also more recently in Dr. Rutherford's edition of "Bonnycastle's Elements."

Ques. 9, by Mr. Abbatt, requires to draw a straight line "through a given point in the common chord of two given intersecting circles, so that the segments intersected by the circles shall have a given ratio." An algebraical solution is furnished by Mr. John Baines, and a geometrical one by the proposer.

Ques. 20 is the prize for No. I, and relates to the determination of the equation to an aperture, which, together with a rectangular one, shall admit of a *constant* flow of water from a reservoir of *varying* depth. It was first proposed by Mr. Walker, of Bilborough, as Ques. 767 of the *Gentleman's Diary*, but the solution there given by the proposer not appearing satisfactory, it was reproposed by J. F(letcher) as Ques. 73 of the Liverpool *Student*, where it was left unanswered owing to the discontinuance of that periodical. On being again reproposed in the *Associate* the required equation to the curve was completely deduced by Messrs. Jones, Gill, and Dr. Rutherford.

Ques. 21, by Mr. Abbatt, requires "from two given points in the circumference of a given circle, to inflect two straight lines to a point in the opposite circumference cutting a given chord, so that the rectangle of the extreme segments may be equal to a given space, or a maximum." The question is analysed by Messrs. Holt and Lomax, who reduce it to Ques. 524 in the *Mathematical Companion*, proposed by Dr. Rutherford. A kindred problem is proposed by Mr. Thompson, of Newcastle, as No. X., p. 3, vol. iii., *Northumbrian Mirror*, where Mr. John Huntington, of Preston, gives an elegant analysis which deduces it to the problem by Dr. Rutherford, previously cited.

Ques. 24, proposed by Mr. Callaghan and answered by Messrs. Wright and Gill, demonstrates, that "if innumerable right lines be drawn so as to cut off equal areas from a given parabola," the curve to which these lines are tangents *is a parabola equal to the given one.* The property is generalized, and some other interesting particulars respecting it, are given in Art. 333, Salmon's "Conic Sections," 2nd Edition.

Ques. 29 is an elegant porism, proposed by Professor Gill, and is thus expressed:—"A circle being given in magnitude, and a point in position, two

parallel straight lines may be found, such that if any right line be drawn from the point and intersecting the lines to be found, the square of the segment of that line intercepted by the parallel lines shall be equal to half the sum of the squares of the tangents drawn from the intersecting points in the lines to the circles." Algebraical investigations of the porism are given by Messrs. Rutherford, Holt, and Baines. The solution by the last-named gentleman is particularly neat; the final expressions are completely given, and the whole furnishes an instructive example of the application of algebra to this class of propositions.

Ques. 34, proposed by Dr. Rutherford, ascertains "the centre of gravity of the *frustum* of a right cone, by means of the position of the centre of gravity of a *complete* cone." Very neat general formulæ are deduced by Messrs. Gill, Rutherford, Abbatt, and Oyns.

Ques. 40, proposed by Mr. Wright, is the prize for No. III., and requires to "find a trapezium, such that the sides, area, diagonals, and diameter of the circumscribing circle shall be whole numbers, and the perimeter a rational square." It was fully investigated by the proposer, and also by Messrs. Woolhouse and Clay.

Ques. 44 is proposed by Mr. Callaghan, and requires when "VX, VY are right lines given in position, and P a given point; through P, V, describe any circle whatever, meeting the right lines at X, Y, and draw the indefinite line XY; to describe the curve to which it is a tangent." A geometrical solution is furnished by Mr. Wright, in which he proves that the curve is a parabola, and infers as a "scholium" that VX, VY are tangents to this parabola, and also that "a circle passing through the intersections of any three tangents to a parabola, also passes through the focus." The question itself is obviously a case of the "celebrated proposition" enunciated in the *scholium*, which appears to have been *first* given by Lambert, in his "*Insigniorés Orbitæ Cometarum Proprietates.*" Dr. William Wallace, however, made an independent discovery of the property, and published it as the prize question, No. 88, Leybourn's *Mathematical Repository*, vol. i., p. 309, O. S. Its solution, together with many interesting deductions by Mr. Lowry, Mr. Robert Wallace, and the proposer, are given in vol. ii., pp. 54-7. He afterwards added Art. xvi., pp. 80-2, "On the Description of Parabolic Trajectories," in order to illustrate the uses to which the property may be made subservient. The same property was also published by M. Poncelet, in the "*Annales des Mathematiques,*" tome viii. p. 9, to whom its *first* discovery was ascribed by "a writer" in the *Philosophical Magazine* for August, 1836. This led Dr. Wallace to make a distinct claim to the discovery, in the Appendix to his "Conic Sections," p. 167, Edinburgh, 1837, where it forms the subject of the first four propositions. He afterwards repeated the claim in his "Geometrical Theorems and Analytical Formulæ," p. 91, Edinburgh, 1839, in both cases instancing the solution by M. Poncelet in the *Annales* as subsequent to his own in the *Repository*. The general property, together with several of its most interesting consequences, form Prop. xiv. of the article "Conic Sections" in Davies's Hutton, vol. ii.; and an analytical demonstration by means of the "*polar equation of the tangent*" is given in pp. 336-7 of the same work. In the scholium to this solution several other demonstrations of the property are referred to, as is also the *prior* claim of "the celebrated Lambert," to its independent discovery. A demonstration of the same, with additional references, are given by Mr. Walton in his excellent collection of "Problems in Plane Coordinate Geometry," pp. 150-1.

Ques. 60 is the prize for No. IV., and was proposed and answered (*without a competitor*) by W. S. B. Woolhouse, Esq., the present editor of the *Lady's and Gentleman's Diary*. It gives "the nature of n different functions $\phi_1(x_1, x_2, x_3 \ldots x_n)$; $\phi_2(x_1, x_2, x_3 \ldots x_n)$; $\phi_3(x_1, x_2, x_3 \ldots x_n)$; ...... $\phi_n(x_1, x_2, x_3 \ldots x_n)$, of n independent values x_1, x_2, x_3, &c. ...... x_n;" and requires to "give a method of ascertaining whether or not a dependency exists amongst them." The solution given by the proposer furnishes an elegant and instructive instance of the application of partial differential coefficients, and was subsequently transferred to his valuable

paper "On the Differential and Integral Calculus," which forms the Appendix to the *Gentleman's Diary* for 1835."

Contributors.—Messrs. Abbatt, author of the "Calculus of Variations," &c.; Andrew, Baines, Clay, Crossley, Duckett, Gill, Godward, Griffith Jones, Hope, Holt, Lester, Maffett, Richardson, Robarts, Rutherford, Sheridan, Todd, Wilmot (*Wilson*), Woolhouse, Wright, &c., &c.

Publication.—The publication took place annually. Numbers I. and II. were "printed for the editors, and published by Davis and Dickson;" the last two numbers were "published by Sherwood and Co., Paternoster-row, London."

THOMAS WILKINSON.

Burnley, Lancashire,
April 28, 1851.

RATIONAL TOYS.

Much as the subject of education has been discussed of late, it does not appear that the good use which might be made of toys has been considered. Amongst Sir Samuel Bentham's papers there is a Note indicating some of those which he denominated "Rational Toys,"—that is the kind of playthings which might instruct as well as amuse a child; the Note was written towards the end of the last century, when his "Naval Seminaries" were about to be introduced.

The construction of toys might seem beneath the dignity of skill in mechanism; yet, considering the influence well-devised ones might be made to have upon a child's mind, the invention of appropriate ones seems to open a new field for ingenuity, and the manufacture of them would probably prove a lucrative speculation. Sir Samuel's idea was, that by varying the materials,—sometimes using costly ones, sometimes those of the cheapest kinds—rational toys might be made to suit all purses.

The following Note was but a hasty sketch, and no attempt was afterwards made to perfect it; thus the omission of toys illustrative of chemical science (for example) may be accounted for.

M. S. B.

NOTE BY SIR SAMUEL BENTHAM.

Rational Toys.—Infantine.

Pieces of ivory or wood of different regular forms as the cube, the globe, the cylinder, &c., to familiarize infants with regular forms of bodies; the appropriate name being assigned to each piece, to enable the nurse to call it by its proper appellation on giving it to the infant.

Balls of the same size, but of different weights to teach the infant practically that different substances are of different specific gravities.

Letters of the alphabet, each on a separate piece of ivory or wood, all the pieces being of the same form and size, as are already the ivory alphabet counters.

Letters of the alphabet on pieces of wood or ivory, cut all of them to a form which admits of their being joined together at pleasure in a fixed line, so as to form words and sentences with them.

Short words, each on a separate piece of wood, so as to be joinable at pleasure into sentences; as, for example—"Good," "Bad," "Sweet," "Sour."

These, and all other infantine toys, should be of too large a size to be put into the mouth.

Rational Toys.—Scientific.

Cubes of the same material, but of different sizes,—as an inch, an inch and a half, two inches, &c., to show proportions, and cubical contents, which may be exhibited by weighing the cubes.

Scales and weights, particularly scales made of china, or of pottery glazed with salt, so as not to be impaired by contact with acids.

Cubes or balls of the same size, but of different specific gravities.

Cubical measures, for liquids.

Pipes of equal lengths, but of different bores, to show that the contents of pipes are in proportion to the squares of their diameter.

An animated cat, or a hard-twisted card, having a weight attached to its end, to show the effect of moisture in twisting or untwisting twisted substances.

Cones, to show conic sections.

Apparatus in glass, to show that fluids keep their level.

Apparatus to show the system of natural springs, and rivers, of interior and other wells, &c.

Prisms.

Small apparatus, to show specific gravities.

A small case of magnets, to show magnetic attraction, &c.

Glass cylinders, sealing-wax, pitch balls, feathers on a stand, &c., to show electric attraction, &c.

Small electrical machine.

Apparatus for showing expansion by heat.

Apparatus for showing expansion by moisture.

Galvanic pile, in small.

A pair of mirrors, mounted so as to be seen at pleasure at different angles one to the other, to show that the angle of reflection is equal to the angle of incidence, &c.

Rational Toys.—Mechanical.

Measures of different lengths and kinds, compasses, &c., &c.

Single parts of which machinery is made up,—as a cogged-wheel, a bevelled-whell, a rack, a pinion, &c., &c., to give clear ideas of the component parts of machines; all the articles being made to the same scale, so as to admit of their being put together,—as the pinion to the rack, for example.

Levers, pulleys of different falls, with weights, &c., &c., to show the mechanical powers.

Working models of many different machines of easy and cheap construction. For example, windmills set in motion by blasts from bellows: waterwheels of different kinds, as overshot, undershot, &c., to which motion may be given by sand instead of water; corn-mills, &c., &c.

Machines, which though of a small size, are capable of being employed for real manufactures; as for instance, a tape-weaving machine, a fringe loom, bobbing-making machinery, stay-lace making, lace making, &c.

Tools, apparatus and materials for making small nails and tacks, the materials being of wire, already cut to proper lengths.

The joiner's outfit, as work bench, tools, glue-pot, deal and other kinds of wood, more or less prepared by planing, by cutting to lengths and widths for boxes, &c: assortments of nails and screws, &c.

Pumps, the barrel of glass, to show the working parts within.

Printing presses.

Models of furniture to take to pieces, so as to show the mode of connexion of the different parts.

Models of the different orders of architecture.

An apparatus for making cakes without touching the materials with the fingers; as provision for beating eggs, for mixing the several ingredients, for kneading, stamping, &c.; an oven suitable for hanging on the bar of a fire grate; another to be heated by a lamp, with proper feet, forks, &c.

Rational Toys.Rural.

Garden tools of a size and weight suitable for children, but at the same time strong enough for real work in the ground; rakes and forks of either wood or metal—if of the latter, the tires or prongs made blunt to avoid accidents.

An agricultural seed-box and calender.

The kitchen gardeners' seed-box and calender.

The florists' seed and root-box and calender.

Cabinet for an *hortus siccus*, with paper for drying plants, and book of instructions.

In addition to toys, the hint was given of contriving furniture for children's use proportioned to their size; chairs for infants had been already made, but none of a proper height for children of a more advanced age, yet not arrived at full growth; and many awkward habits in sitting were thence acquired. For his own children, Sir Samuel had chairs or stools made of different heights, and tables also at which they could sit conveniently, their feet resting on the ground. His paper on rational toys also indicated the expediency of providing knives, forks, spoons, and so forth, of different sizes for children's use. Amongst the articles particularly mentioned, were washing-stands of convenient heights for different ages; and, as an incitement to tidiness and order, chests of drawers for girls, wardrobes for boys—the drawers or compartments of which should be labelled with the different articles of apparel they were intended to contain.

EFFECT OF THE ROTATION OF THE EARTH ON PROJECTILES.

Our correspondent, Mr. Reynolds, was quite correct in his remark (p. 474, *ante*) that a cannon ball in its flight is affected by the rotation of the earth, though its deviation from the vertical plane passing through the axis of the bore does not exactly follow the law which that gentleman has assumed. All artillery-men know full well that projectiles in their path are subject to deviations, both longitudinal and lateral, and that the measures to be used for correcting them, as far as possible, are the greatest difficulties of their service—*hoc*

opus, hic labor est. Besides the deviation arising from the diurnal rotation of the earth, there must be taken into account the irregularities arising from the friction of the shot in the bore of the gun, from the unequal friction of the air on opposite sides of the shot in its trajectory, as well as from the want of exact sphericity and of perfect homogeneity in the shot itself. The first cause of error, and some of the others, are made the subjects of three elaborate *Mémoires* by the late M. Poisson, in the *Journal de l'Ecole Polytechnique, tom.* xvi.; and, to the man of science, the results of the analysis employed by that distinguished mathematician will be far more satisfactory than any that could be derived from the pendulum experiments alluded to by your correspondent. The profound and intricate investigations contained in those *Mémoires* may not, however, be to the taste of the general reader; and we have pleasure in being able to refer, for an account of the results, as well as for the details of numerous experiments of signal importance, made with the improved ordnance now introduced in the British service, to a new and enlarged edition of the celebrated work on Naval Gunnery, by Lieut.-Gen. Sir Howard Douglas, which is now in the press, and from which we have been permitted by its distinguished and gallant author to make the following extract:—

"With respect to the deviation caused by the earth's rotation, it is shown (by M. Poisson) that, when the line of aim is directed from north to south, and from south to north, the lateral deviations are westward and eastward respectively; and when directed from west to east, and from east to west, the lateral deviations are southward and northward respectively; that is, in all cases, towards the right hand of the soldier. M. Poisson also shows that, in latitudes corresponding to the central parts of Europe, a 10-inch shell weighing 112 lbs., when fired in any vertical plane at an elevation of 45°, with an initial velocity equal to 400 feet per second will, on this account, at the distance of 1200 yards, deviate from the mark between 2 ft. 10 ins. and 3 ft. 10 ins. A 12-inch shell, weighing 200 lbs., fired at an equal elevation with an initial velocity equal to 900 ft. per second, will, at the distance of 4,400 yards, deviate from the mark between 15 ft. and 30 ft. Hence, in order to strike an object, the projectile should, if this cause of deviation were alone considered, be fired in a vertical plane, making with a vertical plane passing through the piece and the object, an angle equal to about three minutes of a degree towards the left hand of the line of fire."

The above will suffice to show that the effect of the earth's rotation on the paths of military projectiles has not been overlooked by those whose researches serve as the foundations on which the practice of artillery rests; and in the work from which the above extract was taken there will be found ample evidence of the zeal and talent with which experiments are conducted by artillerists, for the purpose of discovering the means of obviating the errors arising from the different causes of deviation; even, sometimes (as when the eccentricity of shot is made to produce increased ranges) of obtaining from them great and important advantages.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JUNE 19, 1851.

ARCHIBALD TURNER, of Leicester, manufacturer. *For improvements in applying heat for generating steam for motive power, and for other purposes, and in generating heat, and in heating and evaporating fluids.* Patent dated December 7, 1850.

These improvements consist in combining with the use of retorts for generating gas, by the distillation of coal or other matters, the heating of steam and other boilers, by employing for this purpose the otherwise waste heat from the retorts. The arrangement of retorts and boiler which the patentee prefers (without, however, limiting himself thereto), is to employ two retorts, one over the other, heated by a furnace below, and to make the boiler of the wagon shape, but descending at the sides low enough to enclose the retorts and brickwork setting. The course of the heat, after acting on the retorts, may be controlled by flues, and directed around the whole exterior surface of the boiler. Another arrangement (adapted to cylindrical boilers) is, to place the retort and setting in the central flue of the boiler, and to provide suitable flues for the passage and circulation of the heated products. It

has been found to answer well and economically in practice, when the retorts are not required for gas-making, to allow the last charge to remain in them—a very trifling consumption of fuel in the furnace being then sufficient to maintain the requisite degree of heat for heating the boiler.

Claim.—Combining the use of gas retorts with steam or other boilers.

WILLIAM WEILD, of Manchester, engineer. *For improvements in machinery for turning and burnishing.* Patent dated February 11, 1851.

These improvements have relation to the turning and burnishing of cast metal ware, such as saucepans, &c.; and the principal novelty is the method of working the tool-bed—the machine employed being an ordinary lathe. The article to be turned is chucked as usual, and the tool brought to bear on its interior, and kept up against it during its revolution by a weight attached to a cord passed over a pulley, but prevented from cutting too deep by a moveable guard near the point. The bed of the tool is connected by a wormed shaft and wheel with the driving power, and has a gradual traverse through a portion of a circle corresponding to the curvature of the interior of the article to be turned, which has thus every part of its surface subjected equally to the action of the cutter. For burnishing, a suitable tool is to be substituted for the cutter; but the working, in other respects, is just the same.

Claim.—The self-acting machinery described, for dispensing with manual labour in the operations of turning and burnishing cast metal ware.

PETER WOOD, of the firm of Thomas Bury and Co., dyers, calenderers, and finishers, Adelphi Works, Salford. *For improvements in figuring and ornamenting woven fabrics, and in machinery employed therein.* Patent dated December 11, 1850.

The method usually adopted in figuring and ornamenting woven fabrics with metal is to attach the pattern to the fabrics by means of glair or other adhesive matter, either in the state of leaf or finely granulated powder. The patentee combines the metal in a finely divided or precipitate state with starch or other similar substance, so as to produce a pasty mixture, with which the design is printed in the same manner as in ordinary colour printing; or, when both sides of the fabric are required to be ornamented it is passed through a trough of the mixture, and the excess removed by brushes, after which it is dried by steam-heated cylinders. A suitable paste for this purpose is prepared by boiling 6 lbs. of starch and 3 oz. of bee's-wax in 6 gallons of water, adding thereto 28 lbs. of metal, and stirring the whole till well incorporated. In order to produce a glossy appearance, and bring out the full brilliancy of the metal, the printed fabric is passed between calender rollers (but where this process would be attended with injury to the unornamented portions of the cloth other means of pressure must be adopted), and, when necessary, the gloss can be removed from the non-metallized portions of the fabric by any of the methods usually adopted for this purpose.

Claims.—1. The figuring and ornamenting of woven fabrics by the use of a mixture of finely divided or precipitate metal made into a paste with starch or other similar substance.

2. An arrangement of apparatus applicable for the purpose of ornamenting fabrics with such paste.

JOHN MASON, of Rochdale, machine maker, and GEORGE COLLIER, of Halifax, manager. *For certain improvements in preparing cotton and other textile materials for spinning, and in tools, or apparatus for making cards, and other parts of such preparing machinery, and in engines for giving motion to the same, which engines are also applicable in other cases where motive power is required.* Patent dated December 12, 1850.

Claims.—1. In the "devil" or "teaser"—winding the wool into a lap with intervening layers of cloth after it has been operated upon by the machine.

2. In the "scribbling," or "first carding" engine—1. Feeding such machines by two or more laps of wool wound with intervening folds of cloth. 2. The application of a roller with cards upon its periphery to the surface of the taker-in, for the purpose of removing and transferring to the main carding cylinder such of the material as may have failed in being duly delivered to the machine—3. Removing the wool from the doffer cylinder by the action of revolving rollers—4. The application of a roller to the surface of the doffer cylinder, for the purpose of condensing and smoothing the material previous to its being doffed.

3. In preparing "laps"—1. A method of disengaging the lap when wound of the required length. 2. The production of a lap by causing the material to assume the form of successive folds, partially overlapping each other; or, 3, by causing the material to fall upon a travelling surface placed at an angle to the axis of the doffer cylinder.

4. In the "second carding" engine—1. The application of a screw or screws, for giving motion to the conductor of the machine, known as "Brown and Walker's Feeder." 2. Causing narrow laps, which constitute a feed, to overlap each other at

their edges as they pass into the carding machine. 3. Removing the material from condensing-carding engines by means of one doffer cylinder having rings of cards thereon, in combination with two or more stripper rollers.

5. In combing-machines—Removing the material from the combs by means of a combination of a concave surface, or surfaces, and a roller or rollers.

6. In burring-machines—The application of a combination of a concave surface or surfaces, and a roller or rollers, for removing the burrs.

7. In slubbing and roving-frames.—1. Forming the slit in the leg of the flier at the back or front thereof, instead of at the side. 2. In reference to a particular arrangement previously patented by Messrs. Mason and Collier, in which the flier is detached from the spindle, and has an independent motion communicated thereto,—causing the flier to revolve upon, or within a fixed tube or socket. 3. Causing the lower end of the flier legs to revolve in a slot, or circular opening. 4. So regulating the motions of the bobbin and flier in double presser arrangements, that that part of the periphery of the former which receives the material, shall in its revolution recede from the point at which the roving is delivered from the flier. 5. Constructing the patentees' previously-patented tubes, or collars, of equal internal diameter throughout their length, and also of suitable dimensions for receiving spindles of decreased diameter at their upper ends. 6. A peculiar arrangement of creel for mounting the bobbins lower than is usually practised, and facilitating their removal. 7. Arranging the bobbins for supplying a roving or intermediate machine in series, the one placed behind the other. 8. Suspending the creeled bobbins of roving or intermediate machines upon stationary pins.

8. In card-making machines—The application of a star-wheel intermittent motion, for effecting the occasional travelling of the working parts of the machine.

9. In boring-machinery—An arrangement by which two or mores tubes, or collars, may be operated upon simultaneously at both ends, or at each end alternately, without requiring an alteration of adjustment.

10. In cutting "cop bars"—The employment of a rotary cutter, or series of cutters.

JOSEPH BALDWIN and GEORGE COLLIER, both of Halifax, mechanics. *For improvements in the manufacture of carpets and other fabrics.* Patent dated December 12, 1850.

The patentees describe and claim—

1. Certain improvements in the manufacture of carpets, and other fabrics in which the pile is produced by cementing on to the cloth. Heretofore, the woollen yarns for producing the pile have been placed in a horizontal position in a receiver or box, from which successive portions are protruded, and cut off after having been cemented to the fabric. According to this arrangement, the yarns in the lower part of the receiver are thus compressed to a greater extent than those in the upper portion, and there is, in consequence, a want of uniformity in the quantity of pile on different parts of the fabric. The present improvements consist in attaching the pile in a vertical direction, and employing a rotary cutter mounted on a vertical axis. Also, in combining means for sharpening the cutter while in motion, and for removing the fabric when completed.

2. A method of beaming or warping printed yarns, prepared according to the patent of Mr. Richard Whytock. The bobbins, instead of being placed in parallel rows, one next the other, are disposed in radial lines, and in separate series, and thus greater facility of working is ensured. Again; in the ordinary construction of apparatus for this purpose, the upper of the two pinching bars has to be removed altogether from the apparatus when it is desired to remove the pressure during the "setting," after which the bar is replaced, and thus is caused a waste of time, which the patentees prevent by having the upper bar fixed and the lower one moveable, and connected with eccentrics on a revolving shaft, by turning which it can be raised so as to pinch the yarns, and lowered to release them from pressure during "setting." Another improvement consists in attaching a weighted roller to the lower instead of the upper side of the beam, to aid in winding on the yarns.

3. An arrangement for winding weft threads from the swifts on to bobbins or spools, previous to winding them on the shuttle-bobbins, so as to give the thread a quicker traverse at one part of the bobbin than at another; by which means the thread is wound on more evenly and delivered more readily from the bobbins, and the end of the thread is more easily detected in the event of breakage.

4. A method of stopping the working of machines for weaving and cutting pile fabrics, according to the invention of Mr. Christopher Nickels, by shifting the driving belt from the fast to the loose pulley, in the event of the weft failing to shoot; which method is also applicable for preventing the action of the cutter on the warp, when the warp threads are not bound in owing to the failing of the shoot of the weft.

Jean Aime Marnas, of Lyons. *For improvements in the manufacture of indigo.* Patent dated December 12, 1850.

In the ordinary process of manufacturing Saxony blue, and other soluble indigo blues, the sulphate of indigo is dissolved, and the blue abstracted from the solution by means of hanks of wool or pieces of woollen cloth, which are afterwards washed in alkalized water, to remove the colour and obtain it in a separate state, when they may be again similarly employed; and this process is repeated when the colours are required to be very pure.

This continued immersion in acidulated water produces on the cloth a fulling effect, which renders it liable to retain the colour, instead of giving it up readily to the alkaline solution; and the action of the alkali eventually destroys the cloth, and reduces it in parts to a mucilaginous state. The patentee obviates these inconveniences, and at the same time effects a material reduction of expense and an economization of labour, by employing, instead of cloth or hanks of woollen yarn, waste or flock wool and shearings of cloth, which present a large available surface, and readily yield up their colour to the alkaline solution without detriment to themselves. The process of manufacturing is in other respects the same.

Claim.—A better and more economical method of preparing the Saxony blue, and of extracting, easily, economically, and entirely, the indigo blue from the dissolving and washing waters produced in the manufacture of indigo, carmine, and other soluble blues; the process consisting principally in the employment for this purpose of waste wool, and particularly flock wool, which combines in itself all the necessary properties.

William Beckett Johnson, of Manchester, manager. *For certain improvements in steam engines and in apparatus for generating steam; such improvements in engines being wholly or in part applicable where other vapours or gases are used as the motive power.* Patent dated December 12, 1850.

Claims.—1. In "horizontal cylinder engines"—1. The use of a condenser placed under the steam cylinder, and formed in or as part of the framing. 2. The employment of a parallel motion to guide the piston rod. 3. The employment of an air-pump placed at or about the centre of the engine in a transverse direction, and between the cylinder and the main-shaft longitudinally. 4 The employment for working the air-pump of levers forming a bell-crank with the radius bars of the parallel motion. 5. The employment of a hot well cast in, or otherwise forming a part of the foundation plate.

2. In "inverted cylinder engines"—1. The employment of a box framing, circular in its horizontal section, having suitable openings formed therein, and provided either with external or internal flanges or ribs for strengthening the same, and affording means of joining it together when composed of two or more pieces. 2. The employment of a condenser and hot well placed under the steam cylinder, and forming the base of the framing, or part thereof. 3. The employment of a lever or levers for working the air-pump, when motion is given to such lever or levers by connecting-rods worked from the piston-rod crosshead. 4. The employment of slides or guides to guide the piston-rod, having the sides made angular, and either cast with or separate from the framing.

3. The employment in metallic-packed pistons of a spring or springs, so arranged that the expansive power thereof shall act in a line constituting a cord to the circle of the piston.

4. The employment in metallic-packed D-valves of a spring or springs, arranged in such manner that the expansive power thereof shall act in a line constituting a chord to the arc of the back of the valve.

5. With reference to stationary boilers or apparatus for generating steam — 1. Constructing the shell of the boiler in such manner that the form thereof in transverse section shall be composed of two arcs of circles, or of ellipses placed one above the other and strengthened with transverse stays. 2. The employment of a smoke box, placed at the end of the flues, leading from the furnace or furnaces, and surrounded with water, except at certain parts. 3. The employment of curved ends above the furnaces or flues.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman. *For improvements in the manufacture of iron hurdles or fences, and of certain other articles, in the construction of which wire-work is, or may be employed.* (A communication.) Patent dated December 12, 1850.

The first improvement claimed under this patent consists in the crimping or crinkling the warp or weft, or both wires of which such wire-work is composed, in order to admit of the weaving of wires of a large size (such as a quarter of an inch diameter) which has hitherto been considered nearly impracticable, owing to the expenditure of power required to bend such wires during the weaving process. The patentee claims the crimping process entirely irrespective of the machinery with which this operation, or the subsequent one of weaving are performed.

The second improvement has relation to

the construction of panels of wirework. The frame is made in two parts, one or both being grooved, and the ends of the wires being bent down into the groove are retained therein by screwing down the second bar, which may be either grooved or plain. When ornaments are attached, they are made with a stem composed of double wire, which is passed through a hole in the top bar bent down into the groove therein, and secured by attaching the bars together.

Specification due, but not Enrolled.

George Benjamin Thorneycroft, of Wolverhampton, Stafford, iron master. *For improvements in the manufacture of crank axles.* Patent dated December 12, 1850.

WEEKLY LIST OF NEW ENGLISH PATENTS.

James Hinks, of Birmingham, Warwick, manufacturer, for certain improvements in the construction of metallic reels for winding cotton, silk, and other threads, and in machinery for making the same. June 14; six months.

Prospere Durand, of Rue Maragrand, Paris, merchant, for improvements in communicating intelligence. June 17; six months.

Thomas Crook, of Preston, Lancaster, manufacturer, and James Mason, of Preston aforesaid warper, for certain improvements in looms for weaving. June 14; six months.

Francis John Swaine Hepburn, of Notting-hill-terrace, Middlesex, captain, H. P. unattached, for improvements in the manufacture of carriages and other vehicles. June 17; six months.

Godfrey Ermen, of Manchester, cotton-spinner and manufacturer, for certain improvements in the method of and apparatus for finishing yarns or threads. June 17; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Design.
June 12	2840	W. G. Morton	Burnham. Bucks	Equilibrium lubricator.
,,	2841	W. S. Adams	Haymarket	Tap.
,,	2842	G. F. Eckstein	High Holborn	Kitchen range.
13	2843	R. W. Winfield	Birmingham	Chain.
,,	2844	R. Best	Birmingham	Glass-holder nozzle for candle lamps.
,,	2845	D. Collins	Oxford-street	Four-folding portmanteau.
,,	2846	W. M. Mayes	Boston.	Floor-ram.
17	2847	W. Elgood and Co.	Leicester	Le Capôt.
,,	2848	J. Lee	Bread-street Hill	Life preserving and swimming vest.

WEEKLY LIST OF PROVISIONAL REGISTRATIONS.

June 12	246	A. Saxon	Middleton	Throstle bobbin.
,,	247	J. Harding	Exeter	Safety bracelet.
,,	248	J. Harding	Exeter	Double or safety snap.
13	249	J. Mason	Brompton	Shirt.
16	250	R. A. Peacock	Slyne Lodge, near Lancaster	Culvert for railways and other engineering works, and more especially for sewers for the drainage of cities, towns, and other places and districts.
18	251	L. Hicks	Briggate, Leeds	Elastic ribbed waistband for drawers.

CONTENTS OF THIS NUMBER.

The Patent American Corn-Reaper—The Specification—(*with engravings*) 481
Naval Architecture.—White's and Griffiths' Treatises.—Review Concluded 483
Mayes's Registered Flooring-Ram—(*with engravings*) 490
On the Conical-shaped Ball and the Laws of Atmospheric Resistance. By John Potter, Esq., C.E. 491
Mathematical Periodicals. No. XXVII.—The Enigmatical Entertainer and Mathematical Associate. By Thomas Wilkinson, Esq. 492
Rational Toys.—Note by Sir Samuel Bentham 494
Effect of the Rotation of the Earth on Projectiles.—Investigations of Poisson as quoted by General Sir Howard Douglas 495
Specifications of English Patents Enrolled during the Week:
Turner ..... Steam Generating 496
Weild ..... Turning & Burnishing 497
Wood ..... Figuring Woven Fabrics 497
Mason and Collier ... Preparing Cotton, &c. 497
Baldwin and Collier .. Carpets 498
Marnas ..... Indigo 499
Johnson ..... Steam Engines 499
Newton ..... Wire-work 499
Specification Due, but not Enrolled:—
Thorneycroft ..... Crank axles 500
Weekly List of New English Patents 500
Weekly List of Designs for Articles of Utility Registered 500
Weekly List of Provisional Registrations 500

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1455.] SATURDAY, JUNE 28, 1851. [Price 3*d*., Stamped, 4*d*.

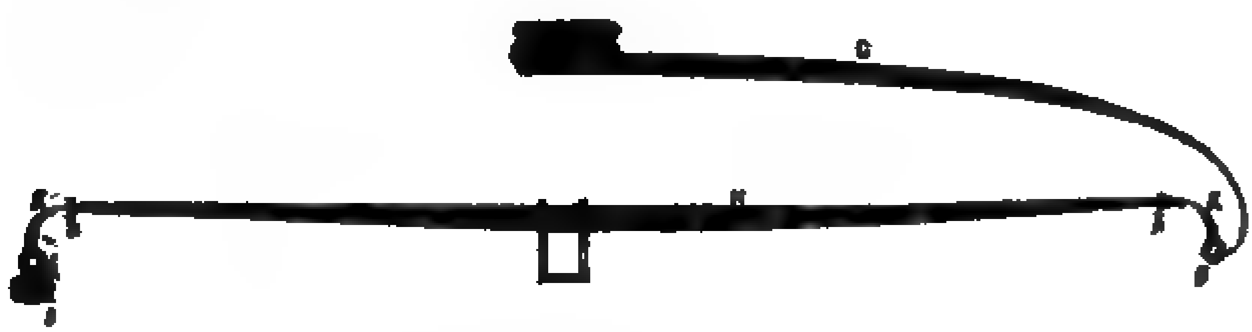
Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. LAURIE AND MARNER'S PERCHLESS CARRIAGE.

Fig. 1.

Fig. 2.

Fig. 3.



MESSRS. LAURIE AND MARNER'S PERCHLESS CARRIAGE.

FIGURE 1 of the prefixed engravings is an elevation of a new and very elegant carriage, just brought out by Messrs. Laurie and Marner, which is remarkable for having no perch, and being entirely suspended from bearings thrown out from the fore and hind axles. Figs. 2 and 3 are separate views of the parts by which the suspension of the carriage is effected. A, fig. 2, is the footboard; BB, part of the fore-carriage; C, C′, brackets fixed to the footboard and box; D, a plate of metal fixed on the cross-bars of the fore-carriage, BB. A strap, or band of leather E, secured at one end to the bracket C, passes over the metal-plate D, and is secured at its other end to the screwed bolt F, which passes through the bracket C′, and is securely fixed by a nut, *d*. The carriage is thus suspended in front on the leathern strap E, to which more or less play can be given by turning the nut *d*. G, fig. 3, is the upper spring; H the under spring; and I, the cross spring for supporting the back or body of the carriage. KK is a strap or band of leather, which is securely held on the top of the under spring I, by means of shackles *k k*, and connected to the upper spring G, at *g* and *h*, and to the cross-spring I, at *i*, whereby the back or body of the carriage is suspended. LL are the wheels, the spokes of which are of a peculiarly curved form, represented in fig. 1.

MR. BILLS'S EXTENSION OF HORNER'S METHOD.

Sir,—I deem the remarks of "A ray of 'P. Q.'s' light" in your No. 1455, worthy of respectful consideration, and I consequently attach some little importance to the clearing up of an erroneous impression that those remarks may have caused.

It would appear from a statement of your correspondent (see page 113), that the suggestion of Professor Davies was published after Dr. Rutherford's tract. But this is not the case. The publication of Dr. Rutherford's tract took place some time after Professor Davies's suggestion. Mr. Cockle's "Analysis" (the first part of it at least, to which that suggestion was appended), was published in the *Philosophical Magazine*, for May, 1848. The preface to Dr. Rutherford's work is dated January, 1849. The inaccuracy of your correspondent may, however, after all, be accidental, and the result of inattention to punctuation, since the insertion of a comma after "and," and also after "after," will render your correspondent's statement correct.

I do not recollect the exact date of the publication of Dr. Rutherford's tract,* but I believe that it did not take place until some months after January, 1849, and I have a strong opinion that Dr. Rutherford's work was not published until after Professor Davies's "Note on Numerical Transformation," which appeared in the *Philosophical Magazine* for May, 1849. It is at the close of this paper that Professor Davies alludes to Horner's Notes on Quadratic Divisors. As dates are often of importance, may I be permitted to ask Dr. Rutherford, through you, the exact date of the publication of his tract? Should this not meet Dr. Rutherford's eye, I should beg your able correspondent, Mr. Thomas T. Wilkinson, to make inquiries of him for the purpose of ascertaining the date, and to communicate it to your readers. Of course, so far as Dr. Rutherford's fame is in question the result of the inquiry is quite unimportant. Dr. Rutherford's merits consist in the union of Horner's process with Davies's, and in their united and successful application to finding the imaginary roots. This *union* gives us the means of treating examples successfully.

The Horner-Davies-Rutherford process is not the only one recently invented for finding imaginary roots. In No. 6 of vol. iii., of the *Mathematician*, Mr. Weddle has given a general method applicable to binomial equations. A notice of Dr. Rutherford's tract appears on the cover of No. 5 of that work, and there are other references to it in the two subsequent Numbers. Your correspondent's surmise, that Mr. Bills had seen the tract, turns out to be unfounded. But surely at the time that it was made

* The Complete Solution of Numerical Equations, in which, by one Uniform Process, the Imaginary as well as the Real Roots are easily determined. By William Rutherford, LL.D., F.R.A.S. G. Bell, 186, Fleet-street.

it was not an improbable one; and even now it may be observed that some notice of the *existence* of such a work might have been expected in Mr. Bills's introductory remarks. But enough has been said on this point, and perhaps Mr. Bills had not observed the notice and references.

Mr. Bills's reply, at page 162, is not entirely satisfactory, either in a theoretical or a practical sense; and I do not think it dwells sufficiently, either on the principles or the details of his process. He does not give any theoretical grounds to justify the extension of Horner's method to "imaginary roots." But, taking this for granted, he justifies his method of making the successive corrections of the root by that sort of argument which is expressed by the words "In like manner." Now it might be made a question whether there is such a relation between real and imaginary roots as to justify this argument from analogy. I shall make my meaning clear by a quotation from "A ray of 'P. Q.'s' light," who observes that "the way in which a pair of imaginary roots is indicated by substitution, as lying between certain real limits of the decimal scale, has no *known* connection with the a, β of the roots themselves." Mr. Bills, indeed, says of his method, "that the results it furnishes are *invariably and rigorously correct*;" but no limited number of examples can authorize us to form such a conclusion. Mr. Bills either begs the whole question, or he seeks to prove a principle by an example. I do not think that either course will be approved of by your mathematical readers. The only use of the example is, to suggest inquiry into the theoretic grounds of the rule.

The example of his process, which Mr. Bills has given, would have been more useful if it had been more completely worked out. As it is, a great part of the details are not given, and considerable labour would be required to verify it completely. Unless we have those details, it is impossible to form any opinion of the *practical* use of the process, for their addition might render the example so cumbrous as to cause the process to be at once exploded, so far as concerns *practical* use.

Mr. Bills does not state how the "initial values in this case are readily found." I should be glad to hear *how* they were found.

I should also be glad to know what other examples Mr. Bills has solved by means of his rule. I do not wish to trouble him for the whole work, but I should feel obliged by a statement of the successive corrections as well as of the final results. Your readers would probably be glad to see a *fully worked out* solution of the following equation, proposed by "P. Q." at page 494 of your last volume, viz.:

$$x^2-4\cdot025x+6=0.$$

"P. Q." has given the initial figures of the roots of this equation, which are

$$2\cdot\ldots\ \pm 1\cdot\ldots\ \sqrt{-1}.$$

This *quadratic* would have formed a far better example than the more troublesome *cubic* which Mr. Bills has discussed; but if Mr. Bills will work this quadratic fully and completely out, without omitting any of the operations, we shall then have not only an additional test of the rule, but also, in an equation of a very low degree, a favourable opportunity of observing the practical value of the process, and how far its admitted tediousness is made up for by its affording a pair of roots.

R. S.

RESEARCHES ON OZONE. BY PROFESSOR HARE.

(From Proceedings of the *Franklin Institute*, March 20, 1851.)

Dr. Hare submitted to the attention of the meeting an apparatus for ascertaining whether the phenomena attending the attrition of pieces of quartz, when rubbed briskly together, had anything in common with those ascribed by Schönbein to a supposed new halogen body, named by him ozone, and made the following remarks. The odour which results from electrical excitement, or discharges between oppositely electrified bodies, has long been familiar to electricians. This odour is of a nature to recall that of phosphorus to all acquainted with the smell which this substance has when slowly oxydizing in the air, while to those unacquainted with the odour of oxydizing phosphorus, the universally-known odour of burning sulphur has been cited as an exemplification. Hence, the often-repeated allegation of a sulphureous smell being conse-

quent to the passage of lightning. A similar property was likewise observed in oxygen, which had been extricated from water by electrolysis. I observed a like odour about twenty-five years ago, when a large tube, used for the inflammation of explosive mixtures of hydrogen and atmospheric air, was burst by the process; as well as upon other occasions, when similar results ensued.

Schönbein, who has attained much celebrity as the inventor of gun-cotton, was the first to associate phenomena of the kind alluded to under one view, and to show that the air which had acquired the odoriferous property in question, however obtained, had certain chemical properties in common. These properties were analogous to those displayed by chlorine, bromine, iodine, fluorine, and cyanogen, which constitute the halogen class of Berzelius; and hence the distinguished investigator conceived that they might be due to some body of that class which had escaped detection.

To this supposed body he gave the name of "ozone," from Greek words which signify the production of odour.

As cyanogen is known to consist of two atoms of carbon and one of nitrogen, it would not appear, *à priori*, to be unreasonable that another body should be formed deserving to be ranked in the same class.

Latterly, Schönbein has advanced the idea that ozonification may be owing to a combination consisting of peroxide of hydrogen and bioxide of nitrogen, or, in other words, of oxygenated water and nitric oxide. But this inference seems to have been invalidated by an experiment made by De la Rive and Marignac. These distinguished chemists ozonized oxygen by putting electric sparks through the gas, while exclusively occupying a tube in which it had been evolved from chlorate of potassa previously fused, and consequently devoid of moisture.

Hence Berzelius, and other distinguished chemists, deemed it reasonable to ascribe the phenomena to a peculiar state of oxygen.

It had long been known that certain elements were capable of very different states—as, for instance, carbon in the forms of tinder, charcoal, anthracite, plumbago, and the diamond.

According to Professor Draper, chlorine, after exposure to the solar rays, becomes more capable of combining with hydrogen under a feeble illumination.

This diversity is displayed in many instances by bodies in what has been called their nascent state, which exists just as they escape from combination. Under these circumstances, they will combine with elements for which, usually, they display no affinity. Thus nitrogen, as it exists in the atmosphere, shows no affinity either for carbon or hydrogen, yet, when nascent, forms with hydrogen, ammonia, with carbon, cyanogen. On this account I have concurred in opinion with Berzelius, that the phenomena ascribed to ozone may be caused by oxygen in a peculiar state.

It is requisite to mention, that among the tests of the presence of ozonized air, the mixture of starch paste with a solution of iodide of potassium is the most delicate. This is dependent upon an inexplicable but well-known property of starch to be rendered blue by a very minute portion of free iodine. A very small addition of chlorine, by seizing an equivalent portion of potassium, liberates enough iodine to produce blueness in the mixture; and, in like manner, a very small proportion of ozonized air, whatever may be its source, renders starch blue by a like procedure.

In like manner, by exposure to ozonized air, strips of paper, drenched with a tincture of gum guiacum, are rendered blue, as these changes would have resulted from the presence of chlorine, and as neither that nor any other of the known halogen bodies could be present, the agency of some undetected body of that class was reasonably to be inferred.

Having given this preliminary brief sketch of the state of our knowledge respecting ozone, it is time to proceed to explain its connection with the contrivance of the apparatus before the assemblage.

It had occurred to me that the smell and coruscations arising from the attrition of quartzose masses, briskly rubbed against each other, might be due to the same cause, analogous, if not identical, with that to which the phenomena of ozone are indebted for their existence.

Nothing could be more unaccountable than this odour. That it cannot be due to any organic matter entering into the composition of the quartz must be evident; in the first place, because the smell is produced by the purest and most transparent specimens of rock crystal in the regular form, and, in the second place, because ignition to bright redness does not destroy nor even diminish the property.

One thousand grains of cellular hornstone, or French burr, on ignition as above stated, lost five grains—that is to say, half per cent. of its weight, without, however, losing the property of producing light and smell.

It occured to me that it might help to remove the mystery, were an apparatus con-

structed by which the attrition of quartzose masses might be made more efficaciously than could be effected by an operator unaided by mechanism. Having suggested this idea to my friend, Professor Henry, he said that I might have such an apparatus constructed at the expense of the Smithsonian Institution. The apparatus, which is before the Meeting, was made accordingly.

Two pigmy mill-stones, of 7 inches, made of cellular horn-stone, known vulgarly as French burr, and resembling those used in grist mills, were procured and supported as in the usual way, one above the other; excepting that the upper one hangs by means of a bolt upon a spiral spring of brass wire, sustained by a cross of iron, resting upon screw nuts, upheld by four iron rods, each inserted at its lower end in a circular plate of cast iron, so as to be equidistant from each other. The surface of the iron plate is turned true, so as to enable it to serve as an air-pump plate. It rests upon four columns, which elevate it from a base board sufficiently to admit of a pulley band, and a larger wheel to work in a parallel plane below that in which the plate is situated. There is also room for a lever, from which a stirrup hangs as a support for the spindle of the pulley, on the apex of which plane extended upwards through a perforation in the axis of the plate, the lower mill-stone rests. This spindle passes through a stuffing-box, so as to be air-tight; the stirrup allowing it to retain its perpendicularity, notwithstanding the curvilinear movement of the lever when employed to raise or lower the stone.

The nuts upon which the cross supporting the upper stone has been mentioned as resting, are so used as to render the lower surface of the stone horizontal, while, as it hangs upon a bolt which occupies the axis of the spiral spring, the pressure on the lower stone, when brought into contact with it, may be made as gentle as necessary. The lower stone being balanced on the point of the spindle, is made to turn with it by means of a pin proceeding from its lower surface and another proceeding from the spindle, which operate on a carrier in a lathe.

In order to put the apparatus in operation, the lower stone is made to revolve by means of the pulley, band, and wheel; while, by means of the lever, the stone is so raised as to produce sufficient contact with that suspended above it. Under these circumstances, scintillation and the odour, which is the object of inquiry, resulted. In no way, however, could I produce the chemical effects of ozone upon iodized starch or tincture guiacum. On directing a jet of hydrogen between the stones, it took fire forthwith; but I could not, by means of a gold leaf electrometer, detect any electricity. When the upper stone was removed, and a piece of an old file of a large size made to scrape over the surface of the lower stone, a conducting connection between the file and the electrometer was productive of no electrical indication.

The plate being ground to fit a large receiver, the stones were in successive experiments made to revolve in vacuo, in hydrogen, and in a vacuity previously replete with this gas, without any diminution of the luminous phenomena. These, it seems from the inflammation of the jet of hydrogen, constitute a simple case of ignition. During the collision of flint with steel, a portion of the metal being struck off, takes fire, and thus is enabled to convey ignition to tinder or spunk. The incapacity of two pieces of quartz to produce fire in like manner, arises from the incombustibility of the particles struck off from them, which consequently cool before they meet any mass with which they are not in contact at the moment when the ignition supervenes.

As the burr stones are opaque, the light is much less advantageously seen when they are both employed, than when the upper one is replaced by a comparatively small mass of transparent quartz. The concentration of the frictional force, and the transparency of the mass under which the ignition is effected, makes the coruscation very brilliant in a room otherwise darkened.

So great is the resistance of the surfaces of the stones when brought into revolutionary collision, that the maximum effect which they are capable of producing would require more force than can be communicated by the human power, through a single hand actuating the stones by means of a wheel, pulley, and band.

Of course cog-wheels might be resorted to, and the power of steam, or that of Professor Page's electro-magnetic machine, employed to obtain a greater effect. I have lately been informed that in English potteries where flint is employed as an ingredient in the ware manufactured, the grinding of this material is productive of an intolerable fœtidity. In an atmosphere thus imbued with fœtidity, chemical effects ought to be observable, if there be any connection between the source of this fœtidity and that produced by ozonizing agents.

It is long since it occurred to me, that the phenomena of light, under all the various hues which it is capable of producing, are ascribed to the undulatory affections of an ether pervading the universe; so the still greater variety of odours which influence

our olfactory nerves may be due to vibratory agitation of the same medium.*

Consistently it may be conceived that the odour produced during ozonification, during the attrition of quartz, is due to an odoriferous ethereal agitation.

INFLUENCE OF THE EARTH'S ROTATION ON PROJECTILES.

Sir,—I knew not to whom my thanks are due for the information given in reply to my letter respecting the influence of the earth's rotation on the motion of projectiles. That information, however, is very acceptable and satisfactory; and though I venture to remark further on the subject, it is not in the slightest degree in depreciation of that reply.

I beg permission then to suggest, that the elaborate investigation of M. Poisson, though most valuable as an *independent assurance*, can hardly be considered "more satisfactory than the conclusions drawn from the pendulum" theory (not "experiments") of M. Foucault; M. Poisson's is difficult, and M. Foucault's, as set forth by Professor Young, is simple: and no sooner did I apprehend this latter theory, than I at once perceived what must be the effect on a projectile; and more,—I saw what must be the "law" of that effect. This law, I beg again to suggest, is quite correctly stated in my first letter, viz.;—"The deviation of the projectile will always be to the right hand, and will vary directly as the range and inversely as the speed." It is this latter part, viz. "inversely as the speed," which I presume the reply deems incorrect; but the objection is erroneous, since, of course, I do not mean the "initial velocity," which does not *alone* determine the "*speed*" of the projectile, but the mean velocity of the whole flight. I shall perhaps be better understood, if I say—*the deviation in any given latitude varies in the compound ratio of the range and the time of flight.* This I am persuaded is correct; and I have only to add that I had no idea, in my first letter, of superseding the other various causes of deviation in the flight of a cannon-ball, but only of adding (as I thought) a new one to their list.

I am, Sir, yours, &c.,
OSBORNE REYNOLDS.

Dedham, June 26, 1851.

MR. PAINE AGAIN!

(From the "Scientific American.")

The simple announcement that water could be readily converted into gases suitable for the purposes of light and heat, by mechanical electricity, had nothing in it to startle the scientific world; but the statement that came with it, that water was convertible wholly into the one gas or the other at the option of the experimenter, raised a clamour among chemists that nothing short of years of demonstration will silence.

As a matter of some interest, and perhaps useful amusement to your readers, I propose to show by argument and demonstration, in as short a space as possible, that the experiments in the "decomposition" of water from Humphrey Davy's day up to the present time, have all been based upon two false positions; first, that the decomposition was due to the passage of the electric current through the electrolytes; and, second, that two separate poles or electrodes were required to enter the electrolyte, such an arrangement being necessary to effect the first-mentioned requirement. That these propositions are orthodox, I quote Professor Brande, "When the electrodes of the voltaic battery are brought near to each other in certain liquids...... so that the *current of electricity passes through them*, decomposition ensues; that is, certain elements are evolved in obedience to certain laws; the water, for instance, yields oxygen and hydrogen...... In these cases the ultimate and proximate elements appear at the electrodes; not indiscriminately, or indifferently, but oxygen and acids are developed at the anode, *or surface at which the electricity enters the electrolyte*, and hydrogen and alkaline bases at the cathode, or surface at which the electric current leaves the body under decomposition."

Now, if it is shown that water can be decomposed by voltaic or other electrical action *without* a current of electricity passing through—or without two poles or electrodes conveying said current into the electrolyte, then all the fine theories of Faraday, Brande, Silliman, and others, must be set aside. In proof that water can be so decomposed or resolved into the gaseous state, I submit the following demonstration:—Make two half circles, one of zinc and the other of platina; solder them together so as to form a circle, and then immerse it in water sufficiently acidulated to act on the

* If odours are to be ascribed to ethereal affections produced by impulses proceeding from odoriferous substances, consistently tastes must have an analogous origin, and mesmeric influence, so far as its existence has been proved, seems equally to require ethereal intervention.

zinc, when hydrogen will be rapidly evolved from the platina. Where are the two poles? Or where is the current of electricity passing through the electrolyte? In the making of hydrogen with zinc and acidulated water, we say the oxygen goes to the zinc and forms its oxide; when water is decomposed by the voltaic battery with a platina electrode for the negative, and a copper rod for the positive poles, we say that the oxygen goes to the copper and forms its oxide; but this little experiment with the ring raises a question as to the truth of these "say-sos." The zinc of the ring can only yield or form its relative quantity of oxide in proportion to the hydrogen liberated; and as the platina does not oxidize, what becomes of the atoms of oxygen which, according to the atomic theory, must be liberated at the same time the platina is evolving hydrogen?

Without venturing to construct a theory, I will venture to remark, that it will yet be discovered that electricity combines with different metals so as to produce different results when acting on the same electrolyte, or, in other words, water may be wholly transformed into different sub-elements by electricity in combination with different metals. Yours,

H. M. Paine.

A PILE-SUPPORTED LIGHTHOUSE SWEPT AWAY.

During a severe storm, two weeks ago, the Lighthouse on Minot's Rocks, 17 miles from Boston, was swept away like a broken reed, and two men drowned. It was a building 75 feet high, and was built on piles sunk 5 feet in the rock, the diameter of which was 8 inches at the base and 4½ inches at the top. On these piles were nine iron pillars sustaining the keeper's house, the floor of which was 60 feet from the foundation. The breadth of the base of the structure was 25 feet; the keeper's room measured from out-and-out 14 feet. The keeper's house, resting on the pillars, weighed 30 tons, and was 40 feet from the sea. Although so heavy, it would rock like a cradle in heavy storms.

The keeper of Minot's Lighthouse, Mr. Bennett, as well as most others acquainted with the case, are of the opinion that no lighthouse can ever be erected on Minot's Ledge of any other material than solid rock, similar to the world-renowned Eddystone Lighthouse. It is stated that the cost of Minot's Lighthouse was 39,600 dollars. It was commenced in 1847—a single pile only being laid that year. In the season of 1848 all the piles, the cap, and the braces, were put up; but nothing was done towards erecting the house or the lantern, as the entire season was consumed in drilling the holes into the rocks for the piles. During the year 1849, the work was completed, and on the 1st of January, 1850, it was lighted; and since that time the lighthouse has been regularly occupied up to the time of its destruction.—*Scientific American*.

ON THE CONSTRUCTION OF STEAM BOILERS AND THE CAUSES OF THEIR EXPLOSIONS. BY WM. FAIRBAIRN, ESQ., C.E., F.R.S.

(Continued from p. 449.)

Again, if we refer to the comparative merits of the plates composing cylindrical vessels subjected to internal pressure, they will be found in this anomalous condition, that the strength in their longitudinal direction is twice that of the plates in the curvilinear direction. This appears by a comparison of the two forces, wherein we have shown that the ends of the 3-feet boiler, at 40 lbs. internal pressure, sustain 360 lbs. of longitudinal strain upon each inch of a plate a quarter of an inch thick, whereas the same thickness of plates have to bear in the curvilinear direction a strain of 720 lbs. This difference of strain is a difficulty not easily overcome, and all that we can accomplish in this case will be to exercise a sound judgment in crossing the joints, the quality of the workmanship, and the distribution of the material. For the attainment of these objects, the following Table, which exhibits the proportionate strength of cylindrical boilers from 3 to 8-feet in diameter, may be useful.

Table of equal strengths in Cylindrical Boilers from 3 to 8-feet diameter, showing the thickness of metal in each respectively, at a pressure of 450 lbs, to the square inch.

Diameter of Boilers. Feet.	Inches.	Bursting pressure — equivalent to the ultimate strength of the riveted joint — as deduced from experiment 34,000 lbs. to the square inch.	Thickness of the plates in decimal parts of an inch.
3	0	450 lbs.	·250
3	6		·291
4	0		·333
4	6		·376
5	0		·416
5	6		·458
6	0		·500
6	6		·541
7	0		·583
7	6		·625
8	0		·666

Boilers of the simple form, and without internal flues, are subjected only to one species of strain, but those constructed with internal flues are exposed to the same tensile force which pervades the simple form, and further, to the force of compression which tends to collapse, or crush the material of the internal flues. In the cylindrical boiler, with round flues, the forces are diverging from the central axis as regards the outer shell, and converging as applied to every separate flue which the boiler contains.

These two forces in a steam-boiler are n constant operation; the tendency of the one being to tear up the external plates and force out the ends, and the other to destroy the form and to force the material into the central area of the flues. These two forces operate widely differently upon the resisting powers of the boiler, which, taken in the direction of its exterior envelope, has to resist a tensile strain operating in every direction from within, and the internal flues acting as an arch, offer a powerful resistance to compression from without. It might be instructive, as well as interesting, to exhibit the nature of these powers, and determine the law by which vessels of this description are retained in shape; but this can only be done by experiment, and as these experiments would have to be conducted upon a large scale, and with great accuracy, in order to arrive at satisfactory results, we must abandon the idea for the present, and content ourselves with such information as we already possess. At some future period I may possibly devote my attention to this subject; it is one of great importance, and a series of well conducted experiments would, I make no doubt, supply valuable data in the varied requirements of boiler construction, and their comparative powers of resistance to the united force of tension and compression.

From the existing state of our knowledge, we must rest satisfied with the fact, that the resisting powers of cylindrical flues to compression will be directly as their diameters, and we may therefore conclude that a circular flue, 18 inches diameter, will resist double the pressure of one 3-feet diameter. Hence it follows that the resistance of wrought-iron plates of the circular form is to the force of compression as their diameters—the same, but with greatly diminished powers—as compared with the resistance of wrought-iron cylindrical plates to tension.

To show the amount of strain upon a high-pressure boiler 30-feet long, 6-feet diameter, having two centre flues each, 2-feet 3 inches diameter, working at a pressure of 50lbs. on the square inch, we have only to multiply the number of square feet of surface, 1,030, exposed to pressure, by 3·21 and we have the force of 3,319 tons, which a boiler of these dimensions has to sustain. I mention this to show that the statistics of pressure, when worked out, are not only curious in themselves, but instructive as regards a knowledge of the retaining powers of vessels so extensively used, and on which the bread of thousands depends. To pursue the subject a little further; let us suppose the pressure to be at 450lbs. on the square inch, which a well-constructed boiler of this description will bear before it bursts, and we have the enormous force of 29,871, or nearly 30,000 tons bottled up within a cylinder 30-feet long, and 6-feet diameter.

This is, however, inconsiderable when compared with the locomotive, and some marine boilers, which from the number of tubes present a much larger extent of surface to pressure. Locomotive engines are usually worked at 80 to 100lbs. on the inch, and taking one of the usual construction, we shall find at 100lbs. on the inch that it rushes forward on the rail with a pent-up force, within its interior, of nearly 60,000 tons, which is rather increased than diminished at an accelerated speed.

In a stationary boiler charged with steam at a given pressure, it is evident that the forces are in perfect equilibrium, and the strain being the same in all directions, there will be no tendency to motion. Supposing, however, this equilibrium to be destroyed by accumulative pressure till rupture ensues; it then follows that the forces in one direction having ceased, the others in an opposite direction, being active, would project the boiler from its seat with a force equal to that which is discharged through the orifice of rupture. The direction of motion would depend upon the position of the ruptured part: if in the line of the centre of gravity, motion would ensue in that direction; if out of that line an oblique or rotary motion round the centre of gravity would be the result.

The velocity or quantity of motion produced in one direction would be equal to the intensity or quantity lost; and the velocity with which the body would move would be in the ratio of the impulsive force, or the quantity lost. Therefore, the quantity of motion gained by an exploded boiler in one direction, will be as its weight and the quantity lost in that direction. These definitions are, however, more in the province of the mathematician, and may easily be computed from well-known formula on the laws of motion.

We now come to the rectangular forms, or flat surfaces, which are not so well calculated to resist pressure. Of these we may instance the fire-box of the locomotive boiler,

the sides and flues of marine boilers—the latter of which, by-the-bye, are now superseded by those of the tubular form—and the flat ends of the cylindrical boilers, and others of weaker construction.

The locomotive boiler is frequently worked up to a pressure of 120 lbs. on the square inch, and at times when rising steep gradients, I have known the steam nearly as high as 200 lbs. on the inch. In a locomotive boiler subject to such an enormous working pressure it requires the utmost care and attention on the part of the engineer to satisfy himself that the flat surfaces of the fire-box are capable of resisting that pressure, and that every part of the boiler is so nearly balanced in its powers of resistance as that when one part is at the point of rupture every other part is on the point of yielding to the same uniform force. This appears to be an important consideration in mechanical constructions of every kind, as any material applied for the security of one part of a vessel subject to uniform pressure, whilst another part is left weak, is so much material thrown away, and in stationary boilers, or in moving bodies, such as locomotive engines and steam vessels, they are absolutely injurious, at least so far as the parts are disproportionate to each other, and the extra weight when maintained in motion, becomes an expensive and unwieldy encumbrance. A knowledge of the strength of the materials used, judicious care, and the exercise of sound judgment in its distribution, are therefore some of the most essential qualifications of the practical engineer. Our limited knowledge, and defective principles of construction, are manifest from the numerous abortions which exist, and although I am free to communicate all that I know on this subject, I nevertheless find myself deficient in many of the requirements necessary for the attainment of sound principles of construction.

Reverting to the question more immediately under consideration, it is, however, essential to give the requisite security to those parts which, if left unsupported, would involve the public as well as ourselves in the greatest jeopardy.

The greater portion of the fire-boxes of locomotive boilers, as before noticed, have the rectangular form, and in order to economise heat and give space for the furnace, it becomes necessary to have an interior and exterior shell; that which contains the furnace is generally made of copper, firmly united by rivets, and the exterior shell, which covers the fire-box, is made of iron and united by rivets, in the same way as the copper fire-box. Now these plates would of themselves—unless supported by riveted stays—be totally inadequate to sustain the pressure. In fact, with one-tenth the strain, the copper fire-box would be forced inwards upon the furnace, and the external shell bulged outwards, and with every change of force these two flat surfaces would move backwards and forwards, like the sides of an inflated bladder, at the point of rupture. To prevent this, and give the large flat surfaces an approximate degree of strength with the other parts of the boiler, wrought iron or copper stays, 1 inch thick, are introduced; they are first screwed into the iron and copper on both sides, to prevent leakage, and then firmly riveted to the interior and exterior plates. These stays are about 6 inches asunder, forming a series of squares, and each of them will resist a strain of about fifteen tons before it breaks.

Let us now suppose the greatest pressure contained in the boiler to be 200 lbs. on the square inch, and we have $6 \times 6 \times 200 = 7200$ lbs., or $3\frac{1}{4}$ tons, the force applied to a square of 36 inches; now, as these squares are supported by four stays, each capable of sustaining 15 tons, we have $4 \times 15 = 60$ tons as the resisting powers of the stays, but the pressure is not divided amongst all the four, but each stay has to sustain that pressure, consequently the ratio of strength to the pressure will be as $4\frac{1}{2}$ to 1 nearly, which is a very fair proportion for the resisting power of that part.

We have treated of the sides, but the top of the fire-box and the ends have also to be protected, and there being no plate but the circular top of the boiler from which to attach stays, it has been found more convenient and equally advantageous to secure those parts by a series of strong wrought-iron bars, from which the roof of the fire-box is suspended, and which effectually prevents it from being forced down upon the fire. It will not be necessary to go into the calculations of those parts; they are, when riveted to the doom or roof, of sufficient strength to resist a pressure of 300 to 400 lbs. on the square inch. This is, however, generally speaking, the weakest part of the boiler, with the exception probably of the flat ends, above the tubes in the smoke-box, where they are not carefully stayed.

(To be resumed.)

HARRIS'S PATENT PORTABLE BAROMETER.

(Patent dated December 19, 1850. Specification enrolled June 19, 1851. Patentee, A. O. Harris, of High Holborn, Philosophical Instrument Maker.)

A portable barometer of this improved description—so constructed that it may be used in any position, vertical or horizontal, or even turned upside

down, and shall remain unaffected in its barometical indications by any changes of temperatures; has long been a great desideratum. We extract the following description of this clever instrument, from Mr. Harris's specification.

Fig. 1.

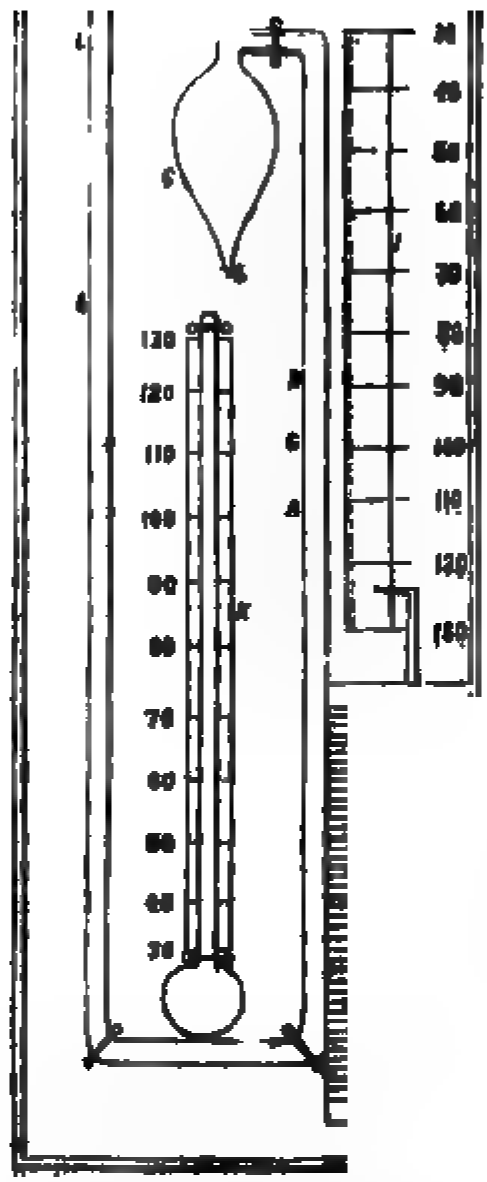


Fig. 2.

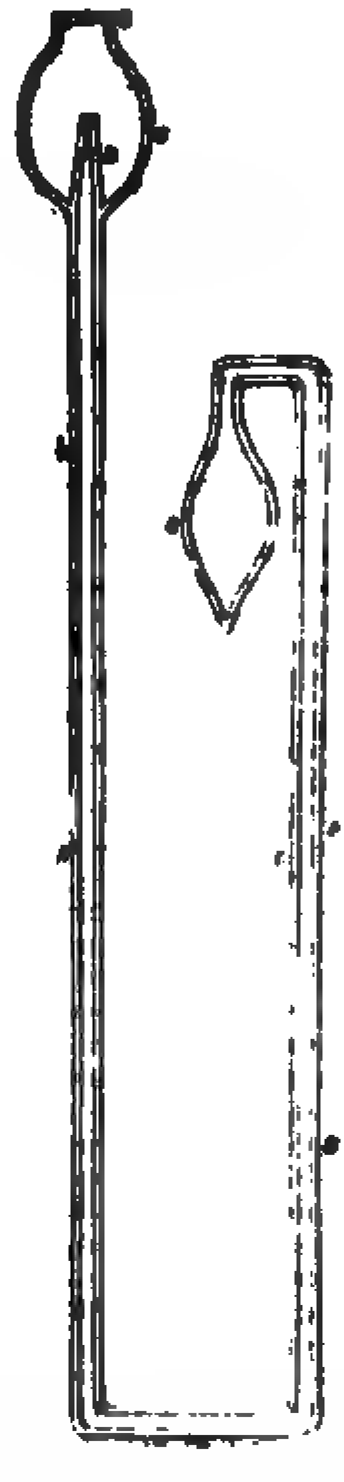


Fig. 1 of the annexed engravings is a representation of a portable barometer constructed according to the said invention. Fig. 2 is a sectional elevation of the glass tube, and bulbs detached from the other parts. A A is the tube, which is about one-sixteenth of an inch in the bore, and bent so that its two limbs L

and R, may be parallel to each other. At one end it terminates in a short-necked bulb B, which is kept permanently open (more or less) to the atmosphere, and at the other in a bulb C, which is only opened for a short time during the adjustment of the instrument, but is ultimately permanently closed. D is a small branch tube, which forms an extension upwards of the main tube A, from the throat of the bulb B, and terminates at about the centre of that bulb. Mercury of as much purity as is conveniently procurable is first poured in through the neck *a*, into the bulb B, (the other bulb C, being at this time closed) until the surface of the mercury rises just sufficiently above the mouth of D, to exclude the atmospheric air, without the film of mercury over the mouth being of weight enough to descend into the tube. An aperture is then made at *b* in the bottom of the bulb C, and carbonic oxide gas forced in through the aperture *b*, into the bulb C, till all the atmospheric air remaining therein, or in either of the limbs, L and R, is expelled through the short branch-tube, D. The aperture at *b* is then hermetically sealed, and more mercury poured in through the neck *a*, until the compression of the gas in the upper portion of the limb R, and bulb C (at the ordinary temperature of the atmosphere) is such that the surface of the mercury in that limb stands at G. Should it be found that there is too much gas contained in the limb R, and bulb C, to admit of the mercury rising to the point G, by compression, then the bulb must be reopened, and a portion allowed to escape. A plug of cane, wrapped round with leather, is then inserted into the neck *a*, the pores of the cane being left open at top, in order to admit of the free access of the atmospheric air into and out of the bulb B. The barometric tube AA, with its bulbs, having been thus filled and adjusted, is put along with a standard barometer K, underneath the receiver of an air-pump, which is so constructed, that it can at pleasure either condense or exhaust. Then, by subjecting the barometric tube to different degrees of pressure, either by exhausting or condensing the air in the receiver, or by both, a scale of pressure H, is obtained, corresponding with the inches scale upon any standard barometer, only that the divisions on the former scale are smaller, because the barometric effect of the atmosphere on the surface of the mercury in the bulb B, is counteracted by the resistance of the gas in the bulb C. In order to apply the scale so obtained, another scale, I, must be formed, which may be a measure (within certain limits) of the expansion or contraction of the gas in the limb R and bulb C, due to any increase or decrease of temperature. It will be seen by referring to the engraving, that the range of temperature provided for in the present instance is about 80°. To obtain this scale, the barometric tube AA, is submitted to a similar process to that generally employed for marking off the scale of a common thermometer; that is, it is subjected to several different degrees of temperature along with a standard thermometer. When the principal points, or the two extremes corresponding with those of the standard thermometer, have been thus marked off upon the tube, then the tube is fixed to the plate, and the space between the points on the tube laid down upon the plate, which is then divided into the proper number of degrees. The scale is now ready for use, as represented in fig. 1. The barometer scale H, is not permanently fixed to the frame, but is made to slide up and down with its graduated edge against the side of the tube, and it carries at top an index-pointer N, the length of which is determined in the following manner:—The instrument is placed along side of a standard barometer, and the division of the sliding-scale H, corresponding to that on the standard barometer, which indicates the true barometric state of the atmosphere, at that time is put in a line with the surface of the mercury in the limb R, and the index-pointer, which is made to adjust, is put immediately over that degree upon the fixed-scale, I, corresponding to the degree of temperature indicated by the standard thermometer K, and fixed in that position. The instrument is now complete, and ready for use. In all subsequent observations to ascertain the weight of the atmosphere, the index-pointer N, is put immediately over the graduation or degree upon the fixed scale I, corresponding to that indicated by the standard thermometer K, when the graduation upon the sliding-scale H, opposite to

the line of the surface of the mercury in the tube, will indicate the height of the column of mercury which is sustained by the weight of the atmosphere in the common barometer for the time being. I prefer employing carbonic oxide gas, to displace the atmospheric air from the limbs and bulbs of the barometric tube: but any other gas which, like it, has no affinity for mercury, will answer the purpose; or even air may be substituted, though not advantageously. The prolongation D, serves to prevent any air in the bulb B, from passing down the tube L, when the instrument is reversed.

GALVANIZED TYPE.

We published recently the specification of an American invention for increasing the durability of types, by facing them with copper—patented for this country in the name of Mr. Brooman (see last vol. p. 219). We now extract from the Proceedings of the Franklin Institute of Pennsylvania for 20th March last the following interesting notice on the subject.

Dr. L. V. Newton, of New York, presented for the examination of the Meeting some specimens of galvanized type, accompanied with examples of printing executed by them, and a letter of recommendation from Mr. W. B. Bodge, manager of the compositors' department of the American Tract Society.

Dr. Newton made the following remarks:

"This patent is one for covering type, &c., made of the ordinary type metal, or any inferior metal, with a face of some more tenacious and durable one. Hitherto copper has only been used for this purpose, and it is probable that, as it is the most tenacious of all metals, with the exception of iron, and proposes certain other advantages besides, it will never be superseded by any other.

"I wish it to be understood, that I do not entirely approve of styling my improvement '*galvanized type.*' The term, whether in point of fact, or as it is commonly understood, does not fully cover all the ground, nor carry all the meaning that the improvement demands. I call it *facing* type anew; and as at present I employ copper for this purpose, and call it *copper facing*. To the new article itself, rather than the mode of producing it, I beg to invite your attention.

"It is apparent to those acquainted with the general character of metals, that, other things being equal, copper is greatly superior to any material of which printing types are usually made. The experiments of Guyton Morveau demonstrate that it is near eleven times more tenacious than lead. Both its ductility and malleability are very great, and admirably fit it for this new purpose to which I have applied it. This deduction from its known character I have already in numerous instances proved true by experiment. There are types on the Table that have performed different amounts of work, in situations where a fair comparison could be made between their durability and the durability of common type. The result has been that while the common type could only, at the most, stand at the head line of a* newspaper page, through a single edition of 170,000 copies, the copper-faced passed through six editions of the same number, placed in the same situation, and, as you may perceive, can scarcely be said, even now, to be entirely destroyed.

"I have other specimens, which have done less work, and are much less worn. Here are types, which appear to be still in excellent working condition, with the hair lines nearly perfect, that have done twice the quantity of work that common types do in the same position. They have, as all copper-faced type have, a beautiful and highly-burnished surface, that shows no disposition to tarnish in the open air. This circumstance is another advantage my type possesses. It requires less ink on the rollers and less on the face of the type, to give a fair and distinct impression: there should, therefore, be less ink wasted, and if the presswork be equal, the printing will look better. I have copies of the New York *Courier* and *Inquirer*, the *Boston Daily Journal*, several large-sized weeklies, both of Boston and New York, as well as several quarterly and monthly publications, all of which are printed on my copper-faced type. Their appearance will speak for the beauty of the work. I have also a specimen of the most beautiful job-printing, done with nearly the finest kind of type in use. Nothing can be more perfect than this. It may, I believe, be fairly assumed, that copper presents a better working face than almost any other metal.

In answer to the inquiry of a member respecting the expense of copper-faced type, I reply that it exceeds that of the common type only about 30 per cent.

It was inquired how the two metals might be separated when worn out, so that the old type metal might be employed again. The

* American Messenger, published in New York, by the American Tract Society.

answer is, that there is no difficulty, as lead fuses at about 500 degrees, and copper at about 1800, so that as soon as the lead becomes fluid, the copper will go to the bottom unaffected by the heat.

Will there not be constant galvanic action between the copper and lead? No, I believe not, because all the conditions for causing electric excitement are not present. There can be no electric action without a fluid to produce chemical changes. When, however, the types are moist, it is probable that at the visible point of contact between the two metals, a certain amount of electrical disturbances may ensue. But inasmuch as the action is wholly at the lines where the two metals join, and not between them, such an action can never have the effect to loosen them from each other. The oxidizement of lead being exterior, will produce no sort of inconvenience; while the copper, thus excited negatively, will repel oxygen, and always remain bright. This effect, I think, I have observed repeatedly. At first I was astonished on seeing the copper maintain a brilliant surface, after it had been used, when, as it appeared to me, it should have been foul or tarnished. On reflection, I concluded it was attributable to this single circumstance of external electric action. As touching types made wholly of copper, that have been spoken of, it will be perceived at once, by applying this fact, that they must necessarily be greatly inferior to the compound type. While moisture would soon so injure the body of the single metal type by rapid oxidation, that it could not be "justified" in lines, and could hardly, if at all, be set up by the compositor: the copper-faced would be quite free from both these objections. Types made altogether of copper, never can be used successfully against my type, for the reasons that I have just assigned, to which may be added their much greater original cost. I may add, that printers, generally, prefer the copper-faced to the common type for working on, because, as they say, they can distinguish the face more readily, and therefore can set it up faster.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JUNE 26, 1851.

SAMUEL BAXTER, of Wapping, shipwright. *For improvements in apparatus for lifting, and for facilitating the working or steering of ships.* Patent dated December 12, 1850.

Claims.—1. A peculiar construction of fixed or portable winch, the barrel of which receives motion from a pinion gearing into a rack formed on the interior thereof. [These winches are constructed with square-ended spindles which fit into suitable holes formed for them in the sides of the vessel, and are intended to facilitate the working of ships by enabling a large amount of power to be applied to the hauling of ropes, &c., with a diminished number of hands. They may be also used for working windlasses and for raising chain cables out of lockers, in which case the barrel would require snugs to be cast on its periphery to receive the links of the chain.]

2. An improved purchase applicable to ships' winches, and a method of working such purchases. Also the construction of purchases so that they may be moved laterally, and thrown into or out of gear with the windlass barrel.

3. A novel form of whelp for windlasses.

JOSEPH BUNNETT, of Deptford, engineer. *For certain improvements in doors, window-shutters, and blinds.* Patent dated December 12, 1850.

Claims.—1. Certain curved forms of laths for revolving metal shutters, having the edges bent so as to overlap each other.

2. A peculiar construction of hinge for revolving metal shutters with curved laths.

3. The employment of a worm-wheel and shaft for raising and lowering revolving metal shutters with curved laths.

4. The application of a balance weight to revolving metal shutters.

5. The application of a stop chain for preventing the opening or raising of such shutters. [This chain is constructed in such manner as to be capable of being coiled or wound up in one direction only, and the links of it (when hanging loosely) abut against each other, and present rigidity sufficient to prevent the shutter being raised from the outside.]

6. A method of closing an inner metal door at the same time as the outer door is shut.

7. A method of opening shop blinds from the inside.

8. A peculiar construction of ventilating-pane for windows, composed of two sets of plates of glass with intermediate spaces between them, arranged in frames, and the one sliding against the other, so as to reduce the amount of ventilation at pleasure.

9. The employment of ventilating sash-bars. [Two varieties of these bars are described. The first is adapted for shop windows and is made hollow all down the centre, and with a series of transverse openings so arranged as to prevent the passage of air directly through the bar. The openings on both sides are provided with plates

of perforated metal, and those on the interior have in addition a sliding plate for closing them altogether when the ventilation is no longer desirable. The second form of bar is adapted to ordinary windows, and is also made hollow, but composed of two thicknesses of metal rolled to the proper form. Each is pierced with corresponding sets of perforations, but the inner one is made capable of sliding up and down so as to shut off, to any desired extent, or altogether, the admission of air.]

10. A peculiar construction of ventilating door, in which the centre is pierced with numerous holes, and provided with a sliding plate to close and open them at pleasure.

11. A ventilating carriage window, having the frame perforated for the admission of air, and provided with a slide to close it at pleasure.

12. A ventilating scuttle or cabin window for ships' cabins on the same principle.

EDMUND MOREWOOD and GEORGE ROGERS, of Enfield, gentlemen. *For improvements in coating or covering metals.* Patent dated December 12, 1850.

In coating zinc with lead by casting, a quantity of lead is first melted in a shallow vessel, and when it has been raised above the melting point of zinc, pieces of that metal are placed on the surface of the lead, or molten zinc is poured on; and after standing some time to allow the metals to separate, in the event of their having become mixed, the vessel is removed, and the slab cooled down altogether, or to about 300° Fahr., when it may be rolled in the customary manner. In order to coat the zinc on the opposite side, when both sides are required to be so coated, the slab is heated to a little above the melting point of lead and sprinkled with sal-ammoniac, and a stick of lead rubbed on until a sufficiently thick coating is obtained. In coating zinc with copper, a slab of copper is prepared by melting in a shallow vessel and allowed to cool down to a little above the melting point of zinc: or a plate of copper is heated to the requisite temperature and sprinkled with sal-ammoniac, or other suitable flux, and the coating is effected in either case by rubbing the surface of the copper with a stick of zinc, till a sufficient quantity has been deposited on it; or two slabs of copper are placed in a mould, and molten metal poured in between them. To coat zinc with tin or solder, the zinc is sprinkled with sal-ammoniac, and heated, and a stick of solder rubbed on until a sufficient quantity is melted to obtain the requisite depth of coating. Lead may be coated in a similar manner, and these prepared sheets may be attached to sheet tinned or zinced iron, by sprinkling the surfaces to be united with weak muriatic acid or sal-ammoniac, and laying the tinned lead or zinc on the tinned surface of the plate of iron, which is to be previously heated to above the melting point of the tin or solder. A heated roller is then passed over the two surfaces, to maintain them in contact and prevent buckling or warping, after which a colder surface is applied, to aid in causing the solder to set rapidly.

Another improvement is the employment of a reverberatory furnace in coating with lead, &c., the surface of the metal to be melted being covered with coal, charcoal, or other similar substance, to facilitate the operation.

No claims.

ALFRED VINCENT NEWTON, of Chancery-lane, mechanical draughtsman. *For improvements in cutting and dressing stone.* (A communication.) Patent dated December 12, 1850.

Claim.—A method of cutting and dressing stone by means of a chisel or chisels resting upon the surface of the stone to be removed at the time the blow is made, so that, by the action of rotating hammers or cams combined therewith, they shall be forced down till the stock of the chisel comes against a rest-bar, which determines the depth of the cut, and the chisel being raised by the forward feeding motion of the stone between each successive stroke of the hammer.

GEORGE ROYCE, of Fletland, Lincoln, miller. *For improvements in grinding, dressing, and cleaning corn and seed.* Patent dated December 12, 1850.

The improvements here specified and claimed are—

1. The application of an annular revolving table to the bed-stone of mills, to receive the ground corn or seeds, and convey them to the spout.

2. A feed apparatus to be applied to the hopper, which consists of a roller provided with projecting pins, which act on the corn and short pieces of straw, and cause a regular delivery thereof.

3. The application of segments of rings to the frames of fan-blowers, by which the frame is strengthened and the action of the blower improved.

RICHARD RODHAM, of Gateshead, practical chemist, and EDWARD ROBERT HOBLYN, of Stepney, gentleman. *For improvements in machinery or apparatus for condensing and purifying smoke, gases, and other noxious vapours arising from fire-places and furnaces, or from chemical and other works, and in rendering the products resulting from such condensation and puri-*

fication available for the manufacture of various colours. Patent dated December 16, 1850.

The patentees conduct the vapours and smoke from fireplaces and furnaces into a circular chamber through an opening near the top, which is made somewhat of a funnel-shape, to allow room for the vapours to expand and present an extended surface to the action of a series of streams of water admitted through pipes at the top of the chamber. A fan, with blades constructed so as to exhaust the smoke in a downward direction, is caused to revolve within the chamber at a high velocity; and the combined action of the water and fans effectually purifies and condenses the noxious particles, which fall into receivers arranged so that the products which pass beyond the first receiver are condensed in the succeeding one. These products, after having been washed, are said to be suitable for the manufacture of various colours, as to the character of which, however, we are, for any information afforded us by the patentees, left quite in the dark.

Claims.—1. The application of fans or blades, placed within a chamber, and caused to revolve at a high velocity, in combination with a stream or streams of water, for condensing and purifying smoke, fumes, gases, or vapours from their noxious and poisonous particles.

2. The arrangement of receivers to retain the products to be used in the manufacture of various colours.

Edward D'Orville, of Manchester, merchant, and John Partington, of Wichen-hall, near Rochdale, bleacher. *For certain improvements in finishing thread or yarn.* Patent dated December 19, 1850.

Claim.—The finishing of damp or wet yarns or threads in a state of tension and of motion, whilst submitted to the drying process.

This system produces a better finish than that ordinarily obtained, and at the same time renders the finished yarn less liable to coil or snarl.

Henry Mortlock Ommanney, of Chester, esquire. *For certain improvements in the manufacture of steel.* Patent dated December 19, 1850.

The peculiarity of this method of manufacture consists in employing iron ores, being oxides of iron, and other oxides thereof previously deoxidized by exposure to different degrees of heat, in an open furnace so constructed that the ore or oxide and carbon may be introduced at a part of the furnace where the temperature is comparatively low, and may be successively removed to hotter parts, being subjected the while to continued stirring; for which purpose, and for the introduction and removal of the matter operated on, each compartment of the furnace is provided with suitable doors or openings.

The patentee has shown and described an arrangement of reverberatory furnace adapted for the purpose of his invention. It consists of three compartments communicating with each other, heated at one end in the ordinary manner, and provided with a hopper at the other end to facilitate the supply of the ores, &c. When the furnace is raised to a proper heat, the compartment at the flue end, or No. 1, being a black red heat, the next compartment, No. 2, somewhat hotter, and No. 3, or that at the grate end, of a bright red heat, the mixture of ore and carbon (by preference charcoal) is introduced through the hopper into No. 1. It is then stirred with iron tools (such as are used by puddlers) for about an hour and a half, when it is turned into the next compartment, and No. 1 immediately charged again. The charges are then passed through all the compartments in succession, and remain in each for an hour and a half; and according to this system the process may go on continuously, each charge being worked altogether about four hours and a half, which has been found to be sufficient to complete the deoxidation. The deoxidized ore or iron, after removal from the furnace, is balled up in the puddling furnace in the ordinary manner; but if it should be found to have a tendency to form itself into lumps, it is submitted to a grinding or pounding process, and, when reduced to powder, passed through the puddling furnace and balled up, as is well understood. The balls when removed from the furnace are made into blooms, or hammered into cakes, plates, or bars, which are afterwards cut up and converted in the converting furnace; or they may be charged at once with the requisite degree of carbonization for steel of any temper, by adding carbon (in the shape of charcoal) in the crucible or melting operation.

The patentee does not claim the exclusive use of the furnace described, except when employed for the purpose of his invention; but he claims the improvement in the manufacture of steel from ores and other oxides of iron deoxidized at successive temperatures, as above described.

David Auld, of Glasgow, engineer. *For certain improvements in steam engines, and in the working of steam boilers or generators, and in apparatus connected therewith.* Patent dated December 19, 1850.

Claims.—1. A method of regulating or adjusting the water-supply to steam boilers,

by means of a steam and water chamber and float in connection with an adjustable valve on the feed-water supply-pipe.

2. A method of supplying water to a range or series of steam boilers working in connection, by a single regulating apparatus communicating with a continuous horizontal water pipe.

3. A method of regulating the water supply by means of an adjustable valve, arranged to permit the surplus water to pass through it when the feed is cut off from the boiler.

4. A method of regulating the water-supply, by means of an adjustable valve placed on the lift or suction pipe of the feed pump, or by a valve arranged to vitiate the action of the pump or supplying apparatus.

5. A method of working or adjusting the dampers or flue valves of a series or range of boilers by a single regulating apparatus.

6. The application of a steam and water chamber and regulating float, or of a float working in one boiler, to an overhead feed pipe, for the supply of a range or series of boilers.

7. A method of drawing off or obtaining steam at a lower pressure than that contained in the supplying boiler, by means of a valve placed in, or working in connection with, the low-pressure steam-pipe branch or receiver, for the regulation of the action of the supply valve.

8. The application of a valve, placed in, or working in connection with, the low-pressure pipe, for the regulation of the low-pressure supply.

9. A method of regulating or adjusting the low-pressure steam supply by the action obtained from the low-pressure steam pipe.

10. The application of a steam and water chamber, in connection with an adjustable valve, for the regulation of the low-pressure supply.

11. A method of regulating the low-pressure steam valve or apparatus by means of a column of water acting on the valve.

12. The use of a valve or regulating apparatus loaded to a pressure lower than that of the low-pressure steam.

13. A method of supplying furnaces with fuel, by means of a receiver worked in connection with a fuel-adjusting apparatus.

14. A method of placing the fuel on the grate-bars of furnaces, by means of a rod or feeding instrument passed through the front or door of the furnace.

15. A method of fitting up furnaces with separating and combining surfaces for the better combustion of the gaseous products of the fuel.

16. A method of working steam-boiler furnaces by causing the combined gaseous products from one or more furnaces to pass through, or in contact with, the incandescent fuel or flame in a furnace or flue before entering the chimney or discharging flue.

17. A method of actuating and regulating the expansion valves of steam engines by means of a steam or vacuum cylinder.

18. The application of direct steam or vacuum pressure for actuating and regulating the expansion valves of steam engines.

19. A method of regulating the rate of motion of steam engines, or the degree of expansion of the steam by means of the governor working in connection with the steam or vacuum valve of the regulating apparatus.

Charles Cowper, of Southampton-buildings, Chancery-lane. *For improvements in the manufacture of files* (A communication.) Patent dated December 19, 1850.

1. According to the method in which files with flat surfaces are at present manufactured, the diagonal cuts for forming the teeth are made in the same direction, that is, each set of cuts has its angle of inclination on the same side of the perpendicular, but it is now proposed to make the cuts incline in different directions, or towards the opposite ends of the file, and this whether the cuts are made by hand or by a machine; or one series by machine and the second by hand. Files thus manufactured are said to cut with less labour, and to clear themselves of filings more readily than those of the ordinary description.

2. The first series of cuts on each side of the file, or on one side only, may be produced by heating a blank, and submitting it to pressure between two dies formed with ridges and furrows corresponding to those on the surface of the file to be manufactured, or between one die thus formed and another die with a plain surface.

Claims.—1. The manufacturing of files with two series of cuts inclined towards the opposite ends of the file.

2. The mode or modes of forming the teeth of files by means of dies.

Philip Nind, of Leicester-square, gentleman. *For improvements in the manufacture of sugar, and in cutting and rasping vegetable substances.* (Being a communication.) Patent dated December 19, 1850.

The "improvements in the manufacture of sugar" have relation to a method of producing it from beet-root, which is also applicable when the sugar-cane is the matter operated on.

The patentee takes about 1,000 lbs. of beet-root, cut into small pieces or slices, and places it in one of a range of eight closed

vessels communicating with each other, and macerates it in water impregnated with sulphurous acid gas (obtained by calcining sulphur or pyrites in a suitable furnace), at a temperature of about 40° centigrade. He then, after a suitable period has elapsed, injects into the vessel a fresh supply of water, which displaces that already therein, forcing it into the second in the range, in which is also placed a similar quantity of beet-root. After the liquor has been forced through each vessel in succession, it is clarified by means of alkaline gas (produced by the combustion of carbonate of ammonia), which causes the deposition of all the foreign and coagulated matters held in suspension in it, and especially the "pectine," a substance hitherto difficult of removal; when it is concentrated at a temperature of 60° to 70° to a strength of about 30° Beaumé, mixed with half its bulk of pure water, agitated, filtered, and crystallized.

The same process is also adopted in treating the sugar-cane, only that it is conducted at a higher temperature—say 80° centigrade.

This portion of the invention also relates to centrifugal machines, especially to a method of removing the reticulated drum after the sugar has been operated on, and replacing it with another; and also to the suspension of such machines.

The improvements in "cutting vegetable substances" consist in employing a cutter with radial blades when acting on the sugar-cane, and those in "rasping," in supplying the cane to be rasped in short lengths.

JOHN HENRY PAPE, of Paris. *For improvements in musical instruments.* Patent dated December 20, 1850.

The improvements claimed under this patent comprehend—

1. An arrangement for producing a synchronous harmonic effect from strings and springs in the same instrument by means of a thread connection.

2. A double-acting hammer for striking the spring and string simultaneously.

3. A method of giving flexibility to the hammers of pianos, and of making the hammers hollow.

4. Certain novel constructions and arrangements of the action of upright, table, and grand pianos.

5. Certain new forms of pianos, and methods of constructing the cases and attaching the sound boards.

6. An improved method of tuning a number of strings simultaneously, applicable to harps and pianos.

7. An improvement in seraphines.

JOHN GEORGE TAYLOR, of Great St. Thomas Apostle, merchant. *For improvements in the manufacture of dress and other pins, and other dress fastenings and ornaments.* Patent dated December 19, 1850.

Mr. Taylor describes and claims—

1. Certain improved dress and brooch pins and fastenings. [Amongst these is a pin with a screw thread or spiral, to secure it to the article to which it may be attached; and a bracelet fastening composed of a length of wire bent into a circle, with the ends turned in, and the bends abutting against each other.]

2. The application of gutta-percha in forming sheaths for the points of pins.

3. Several varieties of fastenings for straps and other parts of dress. [These include a hook of a T-shape, to be used with an elastic eye; a clip for suspending hats; and a button, with a pointed wire spiral attached to the back of it to supersede the necessity of making eyelet-holes.]

WILLIAM HERBERT GOSSAGE, of Stoke Prior, Worcester, chemist. *For improvements in the concentration of sulphuric acid and certain other fluids; also in the use of a certain product, or certain products sometimes obtained in manufacturing sulphuric acid and sulphates.* Patent dated December 20, 1850.

The peculiar feature of the first branch of these improvements is, that the liquid undergoing concentration is diffused in films over a vast number of surfaces, and exposed to the evaporative action of a current of heated air. The apparatus employed consists of a tower or shaft, filled with siliceous pebbles, and communicating at bottom with an apparatus for heating air, or, in certain cases, directly with a furnace. The liquid is supplied from above through a bed of sand and pebbles, and acted on by the ascending current of air as it percolates through the pebbles in the tower. The apparatus is applicable to the concentration not only of sulphuric acid, but also of saccharine juices and saline solutions of different kinds such as those of copperas, &c.

The second part of the invention relates to certain methods of obtaining sulphate of alumina, alum, and salts of iron and copper by the use of the material known as "burnt pyrites," which consists principally of peroxide of iron, but also generally contains copper, but in various proportions.

In order to obtain potash-alum, the patentee takes 200 parts of burnt pyrites containing copper, reduces it to fine powder, and adds thereto 22 parts of chloride of potassium, 80 parts of raw pyrites containing about 35 per cent. of sulphur, and 80 parts of clay containing 35 per cent. of alumina, with sufficient water to give the mixture cohesiveness. He then moulds it into balls about half the size of a man's

fat, which he dries and submits to heat in a furnace of similar construction to that usually employed in the manufacture of sulphuric acid from pyrites, but of at least twice as great depth, adding at the same time sufficient coal or coke to maintain combustion and raise the balls to a red heat. At the expiration of about six hours a part of the charge is withdrawn from the furnace and lixiviated in boiling water, to which is added 4 parts of oil of vitriol to every 100 parts of balls. A solution is thus obtained containing potash-alum, copper, and iron. The copper is precipitated by metallic iron, after which the alum is separated by crystallization, and may be refined for sale or use. The mother liquors of this evaporation contain protochloride of iron, which may be obtained by concentration and crystallization, when the spent liquors may be advantageously employed, instead of water, in treating a second batch of the calcined mixture. By substituting common salt for chloride of potassium, soda-alum may be procured. The process is in other respects the same.

If sulphate of alumina is desired to be produced, then the same mixture as that above described for potash-alum, with the omission of chloride of potassium, is to be prepared and burned in a similar manner. The balls are then lixiviated with hot water and sulphuric acid, as before mentioned, when a solution will be produced containing sulphate of alumina, sulphate of iron, and sulphate of copper. The latter is precipitated by metallic iron; and as this part of the operation will convert the iron in the solution to a protosalt, it is to be exposed to atmospheric air (for which purpose the apparatus described under the first head of the specification is recommended as being very suitable), in order to convert the protosulphate to persulphate of iron. The solution has then just sufficient cream of lime added to it to combine with the persulphate; and after the sulphate of lime and peroxide of iron thus formed have subsided, the clear liquor is drawn off and crystallized, to obtain solid sulphate of alumina, or it may be treated with an alkaline sulphate, and alum produced in the ordinary manner of such manufacture.

To obtain the sulphates of iron and copper from burnt pyrites, it is mixed with one-fifth part of raw pyrites and sufficient moistened clay to provide for its being made into balls, which are burnt as before directed, and after the addition of 8 per cent. of oil of vitriol, lixiviated in boiling water, and a solution obtained holding in suspension protosulphate of iron, persulphate of iron, and sulphate of copper. After precipitating the copper by metallic iron, the solution is evaporated, and the remaining product (sulphate of iron) obtained by crystallization in the ordinary manner.

Claims.—1. The construction of apparatus for effecting the concentration of sulphuric acid and certain other fluids, which apparatus is so arranged that the fluid undergoing concentration is caused to flow in films over an immense number of surfaces, and so that the concentration may be effected by the evaporative action of currents of heated air coming in contact with the films of fluid as it flows over such surfaces.

2. The use of the material known as "burnt pyrites," for the production of sulphate of alumina, alum, and sulphate of iron, or some of these compounds, by mixing this material with raw pyrites and clay, and operating on the mixture or mixtures so produced in the manner described.

3. The extraction of copper, or salt of copper, from the material known as "burnt pyrites," at the same time that sulphate of alumina and sulphate of iron are obtained by the use of this material in the manner described.

WILLIAM HENRY GREEN, of Basinghall-street, gentleman. *For improvements in the preparation of peat and other ligneous and carbonaceous substances, and the conversion of some of the products derived thereby; and also in the mode of the application of some such products to the preservation of substances liable to decomposition and destructive agencies, and which mode is also applicable to other products of a similar nature.* Patent dated December 19, 1850.

Claims.—1. An improved method of preparing peat for conversion into fuel, in so far as regards the mode of introducing the peat into the heating chamber, combined with means of regulating and diffusing the heat.

2. Another method of operation, in so far as regards the consecutive movement of the carriages or wagons carrying the peat through the drying-chamber from the outer end towards the furnace end of the drying-chamber, combined with the application of hot air for the purpose of desiccating the peat.

3. The adaptation of a "rotary separating machine," in which the peat is to be operated upon for expelling the moisture by the joint operations of centrifugal action, hot air, surcharged steam, or heated gases.

4. A method of compressing peat for the purpose of conversion into fuel by means of rollers, whether used by themselves or in combination with a hot plate.

5. An improved apparatus for carbonising peat, in so far as regards the parabolоidal form given to the stoves, and an addi-